AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

VOLUME 20. NEW YORK, THURSDAY, JUNE 3, 1897. NUMBER 22.

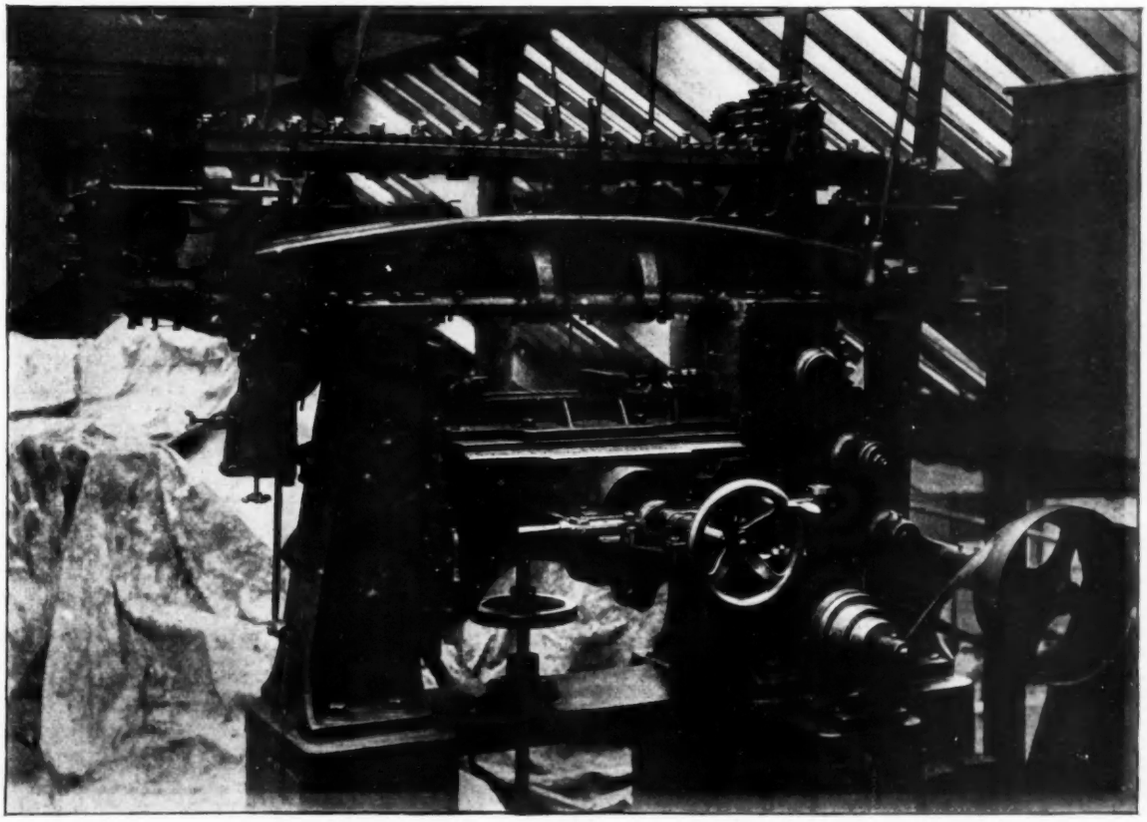
American and Other Machinery Abroad—IV.

[Editorial Correspondence.]

GOOD AND BAD WORK—AMERICAN AND ENGLISH.

Just below London, at Erith are two establishments that are of interest, one that of Frazer & Chalmers, the other the Maxim-Nordenfeldt gun factory. The former is closely affiliated with the Chicago establishment of the same name: its general superintendent is an American, and the Works Manager, Mr. Nicol, a Scotchman who, until about four years ago, had been in America for "four and twenty years," as they say it here. They are building engines and mining machinery, mostly for South Africa, and the shop is excellently built and operated, the tools used being mainly English, with, however, a very fair sprinkling of American and some special machines designed by Mr. Geo. Richards, which I am not inclined to call either English or American, but simply Richards. I do not believe Mr. Nicol, with whom I went about the establishment, has a particle of prejudice either way about the relative merits of English and American tools. He pointed out two American planers and said they were the best planers in the shop, other tools of English make he spoke in equally high terms of. An English slotter and an English boring and turning mill were condemned as poor tools, while others equally English were highly commended. He showed me an English built boring and turning mill, almost an exact copy of the Niles in its general features, but differing from it in having a feed in one direction only, it probably having been considered by the builder unnecessary to have feeds reversible. But unfortunately in choosing the feed the wrong one was chosen, and when the mill was delivered its tool bars would feed upwards only.

It is possible we may have in America a tool builder, with enough of a shop to enable him to build a five foot boring and turning mill, who would make such a blunder, but I am loth to believe it. That our tool builders are capable of mistakes, however, is shown by the performance of an American milling machine of the planer type, i. e., built like a planer, but with two saddles each carrying a vertical milling spindle. The machine, which I saw at work in the shop of an English tool builder, is heavily proportioned and evidently intended for heavy work, but it was taking two light cuts in cast-iron, with cutters much smaller than it was supposed to be capable of driving, and the driving mechanism was so painfully inadequate and the gearing was chattering



A CONTINUOUS PLANER. (See page 19.)

so badly as to make the machine a palpable and disgraceful failure.

A discussion of tools from the men's standpoint, with such a man as Mr. Nicol, brings out the fact, emphasized in other ways, that, in England as in America, there are tools and tools, and no matter which country a tool may have been built in, its quality and adaptation to its purpose will depend much upon whether a first-class, or a second or third-class builder constructed it. American and English lathes differ perhaps more radically than any other of the standard machine tools. For what we would call slugging, i. e., for taking heavy cuts with coarse feeds, I am convinced that the English lathe is in the main better fitted, but its gap, which is clung to with very great persistency, is, I am equally well convinced, an objectionable feature. It necessitates a lop-sided carriage and a low lead-screw, and I find that the most progressive men here generally are disposed to recognize it as objectionable and to say that it is better to put work into a lathe which will swing it anywhere over the shears. I saw a gap lathe blocked up the other day with pieces of rough bar iron under the head and foot stocks, and I saw another one with the lead-screw passing across the gap at such a hight that not more than half the depth of the gap could have been utilized without first removing the screw. Mr. Nicol, with experience with both gap and gapless lathes, prefers them without.

COMPOUND RESTS ON SMALL LATHES—HEAVY GOODS.

The general opinion here, however, is that our lathes are not strong enough, and the chief point of weakness is in the rest. This difficulty arises chiefly, no doubt, from the fact that American lathes cannot be sold here without a compound rest. They will have a compound rest whether or no, on all lathes, from the largest to the smallest, and the result is that compound rests are fitted to lathes of small swing, not one in a hundred of which would have them if they were to be used at home, and which, on this account, have not received the attention they should have. The slides are in most cases too narrow, and the parts too thin and light for anything like good cuts, especially in boring. As a matter of fact they do break them, and if American lathes of small swing are to continue to be sent over here and meet in competition the English lathe, they must, in my opinion, be generally strengthened, in this particular, especially. They do not, I think, generally forge as close to size as we do, and they take heavier cuts in the smaller lathes.

Generally speaking, however, I have so far failed to find here the enormously heavier cuts and faster rates of working of the standard machine tools which I am continually hearing about. I have seen cuts being taken by the best English tools which our lighter and poorer grades of tools would not take, but on the other hand our best tools would easily equal any performance I have thus far seen, and in fact do so as a regular thing. I am speaking now of the heavier class of machine tools and comparing the best makes of both countries—such tools as are used at the London & Northwestern Railway shops at Crewe. Unfortunately heavy American tools are not very plentiful over here, and the best heavy American tools are exceedingly rare. I think if a sprinkling of them could be put at work here we would hear a different story regarding American tools being too light, and the fact would be more generally recognized that when our best builders build a tool for heavy work it is a heavy tool—heavy enough.

DIFFERENT METHODS OF WORKING.

Differences in methods of working continually appear however, and it is not easy to change these. One shop proprietor told me that his men thought the carriage on the American lathe moved entirely too slowly by hand and he had changed the gearing to make it move faster. It was a lathe of about 20-inch swing with a long bed, and the objection arose from experience in running the carriage back by hand the full length of the bed. The proprietor showed me by the pantomimic process how distressingly fast the man had to turn the hand-wheel and how slowly the carriage moved. Of course an American would encounter no such difficulty. He would see to it that the carriage always moved freely and when he had occasion to move it the full length of the bed would simply push it along as fast as he could walk. The change of gearing would spoil the lathe for an American lathesman, because it would destroy all possibility of delicate and sensitive movement of the carriage; but the Englishman uses the compound rest for such movements and prefers it. The Englishman thinks his is best and neither will come to the other's way of thinking very readily or very soon.

USE OF AUTOMATIC AND TURRET MACHINES.

When it comes to automatic screw-machines, turret lathes, etc., such as are used in bicycle manufacturing and to some extent in other lines here, it is quite certain they are far behind our own practice. Their tool making for such work is not generally good, there is a general lack of appreciation of such machinery, and it is usually not tuned up to anything like its proper pitch. An American friend of mine, who manufactures such machinery and whom I accompanied on an expedition to see some of it working in bicycle factories, gave vent to his feelings when he remarked, "You see how it is, Miller; it's like putting a grand piano into a dwelling of a Hottentot." I agreed with him, but, of course, there are exceptions to this, i. e., factories where they are doing very well.

They very generally hesitate to use lard-oil for cutting steel, and depend upon soap suds or soda water, with the result that not nearly so much work can be gotten out of the tools. Lard oil costs more here than with us, but still it is demonstrated that its use here pays when proper means are taken to recover it from chips and work. That which is made here is said to be much more generally doctored than the American oil, and the American is preferred when the advantage of using oil at all is understood, as it usually is after a builder has insisted upon its use as a condition to getting out a decent amount of work, with his machines.

HOW THINGS ARE SOMETIMES DONE.

As an example of how things go I may relate the experience of Ambrose Swasey, whom I had the pleasure of accompanying on a tour of inspection of bicycle factories in a town not far from Birmingham. Warner & Swasey's hub making plants are largely used here and the object was to see some of them in use. The first factory we went into exhibited some engineering work I had not expected to find here. The line shaft was supported in boxes bolted direct to the lower chord of the wooden roof trusses, on top, without any means of adjustment or swivelling arrangement; the boxes were not over 1½ diameters long, had no oilers on them and no drip cups, the surplus oil simply running down over the beams to which the boxes were bolted and dripping to the floor, except when a workman, whose position on the floor made it necessary, had tied on a bunch of waste to absorb it, and thus prevent the oiling of his neck.

The hub forming machine in this shop was found to be working at about half its normal rate. When asked why the slowest rate of feed was used the answer was that when a faster feed was attempted the spring collet slipped in the chuck. As no such experience had been encountered before the feed was put up for the purpose of seeing how it looked when slipping. The entire spindle stopped, and it was of course clear that the friction clutch in the head was slipping and needed a little adjustment to make it clutch tighter. A little judicious use of the screw driver soon made it drive all right and next the counter-shaft friction slipped and had also to be adjusted; then the belt slipped and had to be taken up. Then the speed was increased and the machine was soon working at its normal rate. Nothing more had been done to it than was designed to be done when started up, or at least soon after starting, regular provision having been made for such adjustments. On this machine the universal joints of the oil-pipes leaked and complaint was made of this; an elaborate shield having been made to catch the oil which spurted out continually. It was found that a cock near the delivery was partially closed, probably because it was thought too much oil was being pumped onto the tools.

When this was opened the leaking ceased. When they changed from back gear to direct driving, or vice versa, they first stopped the machine, then threw the gears in or out, then threw the friction clutch in the head and then started up the machine again, thus effectually destroying all advantage of the friction clutch in the head. In this connection it might be pertiment to inquire if it would not be as well to abandon the eccentric in the back gears of such machines and fix the gears permanently in place on a plain shaft. It would be cheaper and the gears would then have to remain where they are really intended to remain, i. e. in engagement. E. P. Bullard has for some time followed this plan and it seems to answer every purpose.

An important difference between the American and the British workman of that class was shown when, upon leaving, the man in charge of the plant plainly signified his desire to drink the health of Mr. Swasey at Mr. Swasey's expense and received the coin required for the purpose. The tipping custom is becoming more and more prevalent in America, but American shop workmen certainly are very far above participation in it, as I suppose the best mechanics here are also.

At two other places visited the same afternoon the machines were found to be doing fairly well, but in both the speeds were slower than normal. And it is here certainly not a matter of harder stock, because American stock was being used; it having come to be quite generally believed here that a certain American concern makes the best steel for such things as hubs, cones, etc., and tons of it are being sold here.

APPRECIATION OF THE "AMERICAN MACHINIST."

If the contributors of the "American Machinist," and American machinery men generally, whose intelligence, liberal mindedness and enterprise make such a paper possible, could hear all the complimentary expressions regarding the paper that I hear over here I am sure they would feel highly complimented and gratified. It is freely credited with having done a most important work in connection with the introduction of American machinery over here. We have many readers here who show by their familiarity with the subjects treated that they miss nothing of importance from the front cover page to the last one and they declare that if they never see an American shop they are yet with us in spirit.

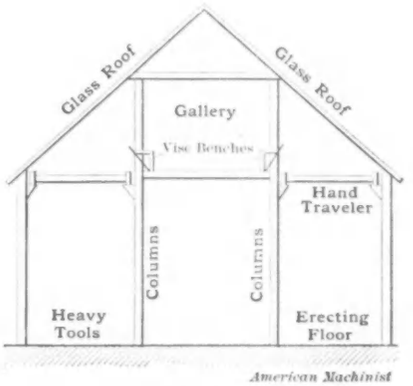
The new shop of John Roper at Wolverhampton is a model of its kind; at least to American eyes. He makes bicycle parts and with rare exceptions his equipment is entirely American. He believes in our methods and tools and keeps in touch with us by reading regularly, the journal which I am frequently assured is the only one that amounts to much for those who are interested in shop practice and machinery. I have with me the foreign mailing list, and when any given firm is mentioned to me as being particularly progressive and enterprising, or as having a particularly good and well-managed place, I am sure to find on the list the name of that firm or its manager, and to find on visiting the place that I am no stranger there, and that the work of American mechanics as set forth in our columns is generously appreciated.

A CONTINUOUS PLANING MACHINE.

The works which go on under the name of Chas. Taylor, in Birmingham, are owned and operated by his sons. They make machine tools of the pure English type, mostly for brass work. I saw here a curious experimental machine designed to do planing continuously, and they very kindly started it up to show its working. I inclose a photograph, which, though not a very good one, may serve to show the principal features of the machine. There are two columns, between which is a saddle that is fitted to both of them, and can be adjusted vertically. On this is a platen which can be fed through between the columns, and this holds the work. Connecting the columns at the top is a cross-beam, the lower side of which is a gibbed slide, and the endless chain of blocks seen above passes through this. They fit the slide closely like the ram of a shaper, and the drive is so arranged, that they are pushed through—not pulled; thus bringing no stress upon the connections when at work. The pinion at top merely takes up the slack, the main drive being below at the right, and the blocks moving from right to left when cutting. In each block are two cutters, and on each block are rack teeth. At the left the slide is extended outside the column a little, and at this point an emery-wheel is mounted which, when in use, is raised by a cam just as a cutter passes over it, and thus each cutter is ground in place with the proper clearance, and all at the same hight. It will be conceded, I think, that this is rather a bold and original piece of work, and it has surfaced a block 2 ft. by 6 in. in two minutes. Two feet is the extreme length taken by the machine, and it is, of course, clear that if made to take any increased length, its rate of planing would be correspondingly increased. In other words, a piece 4 feet long would be surfaced in the same time, were the machine built to take work of that size.

A CENTRAL GALLERY.

The machine stands on what to me is rather an interesting variation of the gallery idea, which in this case is an outgrowth of somewhat peculiar conditions. Instead of the gallery being at the sides of the shop, as usual, it is in the middle, and is arranged about as shown in the accompanying sketch. The roof is practically all glass, and is the main, if not the only source of light. As will be seen, the gallery is, of course, fully exposed to the light, and that portion of it at each side of the gallery lights the floor below; the space under the gallery getting light from each side. The sides of the gallery, instead of being carried up straight, are at right angles to the roof, thus interfering with the light as little as possible. Hand-travelling cranes cover the heavy tool and erecting floors, and lighter tools are placed below as well as upon the gallery. There are better lighted shops (with saw-tooth roofs), but this makes the best possible



Sketch. Cross Section of Shop with Central Gallery

use of the available light, and at the same time utilizes what would otherwise be waste space.

CUTTER GRINDERS WITH BALL SLIDES.

I noticed some cutter grinders in this shop, one feature of which at least is admirable. The slides run upon hardened steel balls, and they not only move with very pleasing freedom, but they do not clog up with emery dust and refuse to work at all. They need no lubrication, and the idea is, it seems to me, an excellent one.

SOME EXPERIENCE OF REPRESENTATIVES.

In Birmingham I met Wm. B. Murdock, who is here in the interest of the Pratt & Whitney Company. He is a shop man who has paid special attention recently to automatic machines, and is meeting with very good success here in introducing them. Naturally he has some interesting experiences to relate growing out of the differences in shop and business customs, and, among other points, says you must not introduce yourself as "representative." You will get much better attention if you are a principal. Failing in that, you must be an "engineer," or in many cases they do not care to bother with you. There seems to be a reason for this, in the fact that they understand that an engineer will be prepared to discuss mechanical matters intelligently, and in detail, and can draw up specifications and arrange for the systematic manufacture of a given piece or machine and arrange the plant for it. This is a large portion of his work at present. Next to this, and especially in some sections, you must wear

a silk hat and a frock coat. As we express it, they "cut ice," though to an American they seem illy adapted for a business attire.

In the same place I met also Mr. Gould, who represents Jones & Lamson, and is introducing the Flat Turret Lathe, with success now, though at first its novelty made it slow work. Mr. Gould expects the machine to be copied here as soon as English tool builders become somewhat less rushed with orders, but thinks it cannot be made so cheaply of equal quality, unless their methods of manufacture are also adopted. He says that when he tells a British friend that with a shop working about 125 men they turn out 18 to 20 of these lathes per month, weighing 20 to 22 cwts. each, it is regarded as a pretty tall story, and very naturally so in a shop where a man was actually observed to take 2½ hours time facing up a gear wheel which in the Jones & Lamson shops would have taken a boy not over 15 minutes. This also seems like a tall story, but I have no doubt is literally true, though, of course, it does not by any means represent the best, nor probably the average practice here, but only the practice of quite a number of old shops which somehow manage to live in competition with the others. Mr. Gould says he has seen such work being done by the old hand tooling process.

AN ENGLISH TOOL SHOP.

Among the busiest of tool shops in Birmingham is that of H. W. Ward & Co., a new concern which is composed of men formerly connected with the older establishment of Archdale & Co. They have advanced ideas, a new shop and new tools, among them some of American origin, which, generally speaking, they do not think very highly of. Their objections to the lathes are the familiar ones, and they are building engine lathes on which they are doing good work, but they are strictly English, and in an American shop would certainly be as little liked as ours are in Ward's shop. It is evident from an inspection of what they are doing that they do not hesitate to adopt such American ideas as commend themselves to them; not in the sense of being mere copyists only, however, for they modify and adapt to suit their own market; especially making everything heavier. It is not the custom here to provide a drill-press with all sorts of feeds as we frequently do—lever, wheel and worm, and quick-return. This idea of a drill-press has commended itself to this firm, however, and they showed me a machine embodying these features as well as internal, concealed back-gears and automatic feed release. The machine was nevertheless not a copy of any American machine, but heavier—longer and larger sleeve on the spindle, and generally more in accordance with the prevailing idea that a machine tool ought to work 30 to 50 years and still be good, to secure which they do in some cases I am convinced sacrifice something of those qualities of handiness and convenience which we pay so much attention to and generally consider of commanding importance. This drill-press appeared convenient enough, however, and aroused my admiration. It represents a type of tool, which there is some reason for believing will before long be generally produced here, and which will eventually prove to be our most formidable competitor in the market, i. e., a line of tools embodying our best ideas, but heavier and otherwise made to conform more nearly to British ideas.

AN AMERICAN BLUNDER.

In a Birmingham shop I was shown an American heavy milling machine intended for such work as is ordinarily done upon the planer. There was an outboard support for the cutter arbor, arranged to move vertically upon a post by means of a screw connected by gearing with the screw which raised and lowered the spindle carrying saddle. In order to get a long cutter, such as the machine was evidently intended to use, on or off the arbor, it was necessary to take out the bolts which held the outboard post, disconnect the gearing and remove the post—a most unpardonable blunder in construction, and one well calculated to inflict serious injury upon American tool trade here. Fortunately for my own peace of mind the machine came from a builder whom I personally have never regarded as being in the first rank, indeed quite the contrary; but a knowledge of the relative standing of American tool builders cannot be expected here generally, and indeed some ludicrously erroneous opinions on that point have been expressed to me on several occasions by Englishmen.

MR. AUSTIN'S WORK.

Of course I went to see Mr. H. Austin, whose letter criticizing American machine tools appeared in our columns some time ago. He has some tools from what I consider our best builders and some not from our best. He is a man of ideas on mechanical subjects, inventor and patentee of some very ingenious improvements in sheep shearing machines, which are manufactured in large numbers, principally for the Australian, but to some extent also for the American market. The machine somewhat resembles our hair clippers, but is arranged to drive very rapidly by power. All working parts are of steel, hardened and ground, and good work is being done upon them. A new department of the works is just being fitted up to produce bicycle parts, and it is equipped with American machinery generally, if not solely; a circumstance which gives evidence of the fact that though not regarding all or perhaps any of our tools as beyond the possibility of improvement, he yet appreciates their good qualities.

ONE-HALF OF POSSIBLE PRODUCTION—AN EXAMPLE OF THE USE OF CAST GEARS.

An interesting place to visit is the shop of the Accles Company, which is in a suburb of Birmingham, and the chief business of which is the production of fixed ammunition—sporting and for military purposes, up to the largest sizes, though they also make bicycle parts and are building and equipping for making steel tubing. Mr. Accles who, though he has been here a long time, is an American, and I believe commenced his mechanical training at Colt's Armory in Hartford, says without reserve that with the same factory in America he would produce twice as much work. When I asked him how this could be he said he would get it out of the people. Asked if it were not possible to take a given job known to be slack and tune it up to the required pitch, he said "Yes, perhaps it would be possible if you could stay by it long enough, and at first you think you will do it, but after a time you conclude you wont do such wonders and will in a measure accept things as they are." The establishment, which is a large one, and part of it quite old, is equipped almost exclusively with American machine tools, and Mr. Accles declares he has no use for any others.

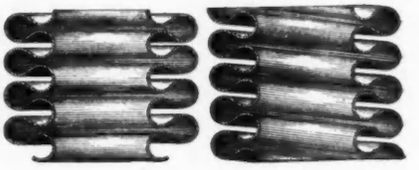
Those who have been considering the refinements of elevating screws for planers, as brought out in recent discussions in our columns, would be interested in seeing an English planer here, which has bevel gears for the elevating screws with cast teeth; which seems to me about as vile a thing to do as to it would be to put cast gears into a watch movement. F. J. M.

Manchester, Eng., May 10th.

▲ ▲ ▲

Flexible Metallic Tubing.

The metallic tube illustrated herewith is the subject of a recent United States patent, the patentee being a British subject and a resident of Germany. We reproduce the sections of the tube here as a matter of general mechanical interest. The tube is made, or may be made, in parallel rings, as shown in Fig. 1; or helically, as

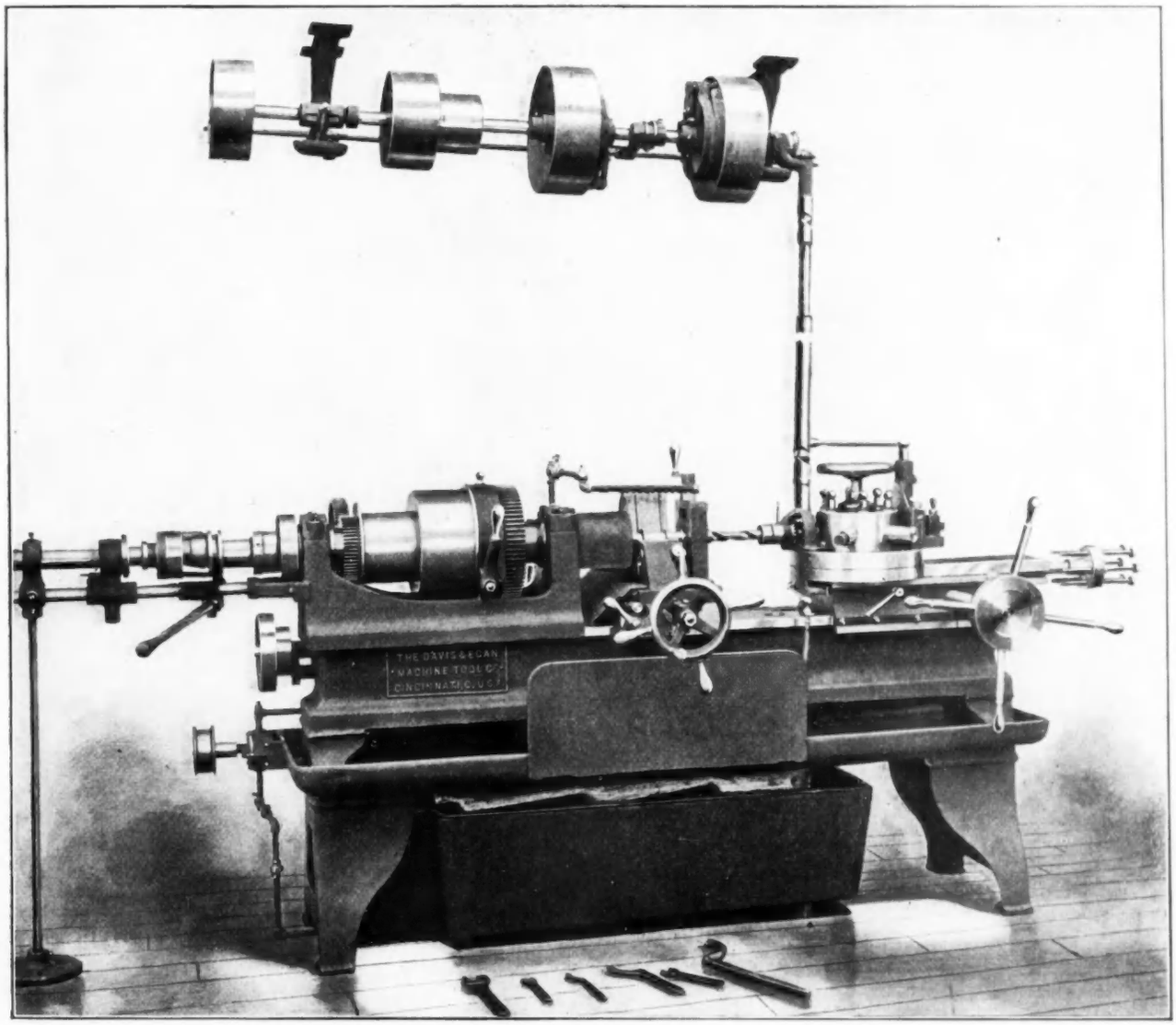


FLEXIBLE METALLIC TUBING.

in Fig. 2. It evidently possesses the desirable property of flexibility to a certain extent, and it would also have a decided tendency to elongate under pressure. The latter feature might perhaps be taken advantage of for gages or for automatic pressure regulating devices instead of diaphragms or leaky pistons now frequently employed. The patentee is Solomon Frank, Frankfort-on-the-Main, Germany.

Hub-Forming and Drilling Machine.

The accompanying half-tone shows a bicycle hub forming and drilling machine containing some new features, among which will be noticed at once a special drive for the twist drill mounted on the turret, which is obtained through a ball and socket shaft connected by bevel gears to the countershaft. The purpose of this is to give an increased speed to the drill so that the hole may be finished in the time required by the forming operation.



BICYCLE HUB MACHINE.

The ball and socket and telescopic joints enable the drill to be swung around with the turret movement without disconnecting it. The drill is provided with oil passages that are connected with the oil supply pump by means of the special tube shown. Roughing and finishing forming tools—the former serrated to break up the chips—are mounted upon the two sides of the hub rest, while a graduated collar upon the cross-feed screw enables accurate diameters to be produced without the use of calipers. The addition of a turret to the machine enables additional operations to be performed on bicycle hubs over those of forming and drilling, such as counterboring and threading. This turret will be seen to be of a new construction, having the usual arrangement of holes for receiving tools, and in addition an annular T-slot around the base for receiving such tools as are suited to that method of mounting. The turret will also be seen to be fitted with an assortment of stops—one for each tool—an arrangement which in a great measure facilitates the setting of the tools, as each one is adjusted for its own work alone and without regard to the setting of the tools which have performed previous operations. These stops revolve automatically with the turret, so that the proper stop is always in position for the tool to which it belongs.

It will be seen that while this machine is more especially a hub-making machine, it is at the same time a regular turret lathe, as the hub rest and its attached tools can be quickly removed.

The machine is furnished with a geared friction head and an automatic chuck and feeding attachment which enable the operator to grip, feed and release the bar and to throw the back gears in or out, without stopping the machine.

The machine is the product of the Davis & Egan Machine Tool Company, Cincinnati, O.

▲ ▲ ▲

Five prisoners recently escaped from a jail in India, having cut through an iron bar two inches in diameter by means of a piece of string, a little sand and some grease. The prison officials afterwards made some experiments in the same line and found that the feat could be accomplished in five hours. We remember having seen, a great many years ago, a casting guarding the corner of a bridge pier, and probably three-quarters of an inch thick, which had been cut entirely through at the corner in half-a-dozen grooves by the towlines of passing canal boats.

Twist-Drill Grinding Attachment.

We illustrate herewith a portable rig readily attachable to any common emery grinder or grindstone and capable of grinding twist drills with all the accuracy of the special and elaborate twist drill grinders. In Fig. 1 the device is shown clamped to a small emery grinder as in actual use, while in Fig. 2 the same device has been clamped to a board with a wheel in proper relative position, and showing more clearly the details and mode of operation.

The clamps at the side are attachable to the edge of the trough or plate and approximately opposite each other. The V-rests are adjustable both vertically and horizontally. Exactness of adjustment is not required in the position of the clamps relative to each other, nor in their distance from the wheel, nor in the hight of the V-rests, nor is it necessary that the face of the emery wheel or grindstone be true, nor that in taking a second cut both horizontal screw nuts be operated. Exactness in manipulation as in the usual machines for twist drill grinding is not necessary. The drill holding bar may be lifted out of the V's when not in use and other grinding may be done on the same wheel.

The drill is placed as shown and moved resting the two edges of the flute on a V-knife edge plate, where it is held securely by one hand. The gage is turned or slipped to one side out of the way, and with the other hand grasping the shank end the device is oscillated and moved on the V's clear across the face of the wheel

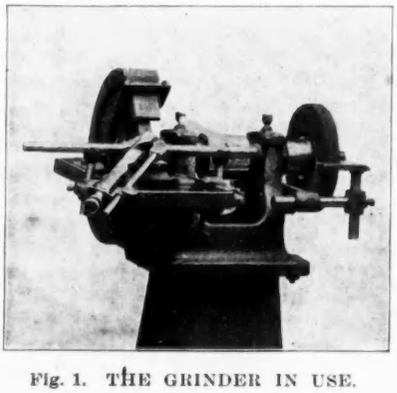


Fig. 1. THE GRINDER IN USE.

or grindstone. The drill is then turned over, and the other lip ground in the same way, perfectly even lips being secured. To grind the rear of the lip, as suggested by Prof. Sweet, or to grind flat drills, the apparatus is slid along the face of the wheel without oscillating. It is pointed out that

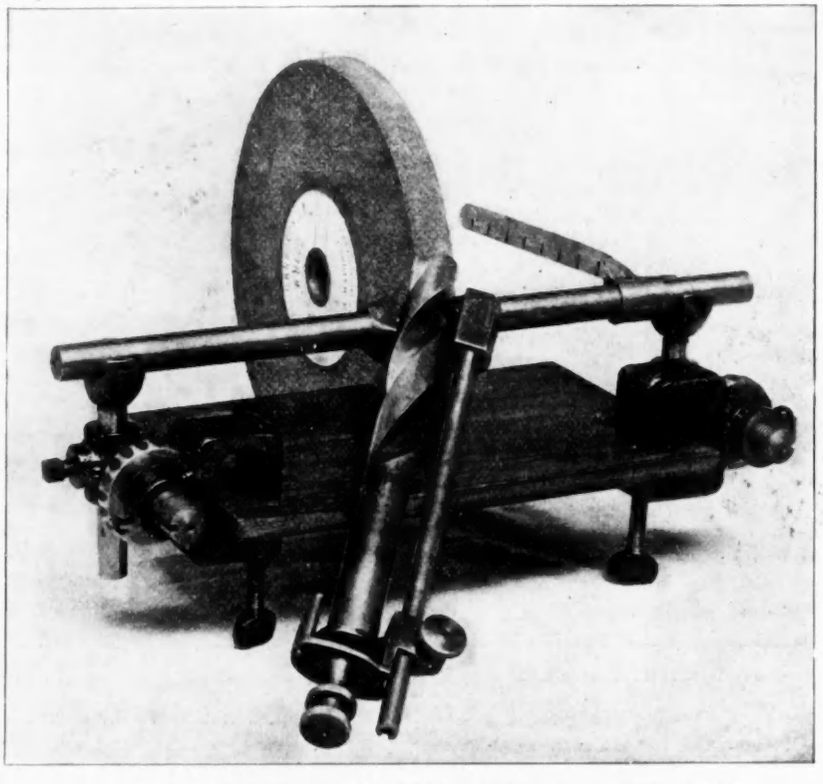


Fig. 2. A PORTABLE TWIST-DRILL GRINDING ATTACHMENT.

forward or backward by loosening the knurled binding screw on the splined rod until the point of the drill touches the gage at the mark corresponding to the diameter of the drill. A finer adjustment may then be made by operating the knurled screw at the end of the shank of the drill against which it abuts, the other end of the drill the distance from the center of the horizontal bar, relative to the distance of projection of a given size drill (hence the gage) and the passing of the drill clear across the face of the wheel, the angle and the oscillating movement solve the problem of grinding twist drills successfully, and in a manner obviously impossible to do by hand or except by resort to a complicated and more or less expensive machine.

The apparatus is made, in four sizes, grinding drills from 0 to 2 inches, by the Appleton Manufacturing Company, Philadelphia. One set of the clamps and V's will carry all four sizes.

▲ ▲ ▲

A Canadian Example of Heavy Fly-Wheel Construction.

We show herewith some interesting views from the interior of the shops of the Laurie Engine Company, of Montreal, which illustrate some processes used there in connection with the construction of heavy fly-wheels which possess points of interest and novelty.

Fig. 1 shows a horizontal boring, drilling and milling machine, the operation in progress being that of milling off the joints of a heavy segmental fly-wheel, the method of doing the work being obvious from the illustration.

In laying out the segments, the Laurie Engine Company use a table of natural sines by which the chord for a given angle of segment can be determined with any required degree of accuracy, while errors of construction are reduced to a minimum. A planed board is attached to the casting, extending to the center of the shaft; an arc is drawn on the wheel rim and the chord laid down with prick punch marks. In setting the first arm on the milling machine, the board is left in place, the center point and extremity of the chord are set parallel with the frame of the machine, and the pivot pin seen in Fig. 1 is located. When finished, a gage is made from the face of joint to the guide edge on milling machine, and the following arms are then set to this gage at the rim, the location of the hub ends being determined by the pivot pin.

Fig. 2 shows the same wheel in the lathe with the operation of turning just completed. It will be seen that the wheel is turned upon its own shaft and practically its own bearings, although a portion of the shaft nearer the wheel than the actual journal is employed to carry the weight. The shaft is carried in temporary bearings which are made of frame castings babbitted up in each case to suit the shaft being turned—the babbitt being removed, remelted and poured again should the next shaft be of different size, as, of course, it usually is. The lathe will be seen to be a pit lathe having some features which are not always found in such tools, the head as well as the tail stock being arranged to slide endwise upon the bed so as to admit the shaft, while the tail end of the bed slides on the foundation to open or close the pit.

Were positive alignment of the shaft with the lathe necessary, a good deal of time would, of course, be consumed in securing such alignment, but, in point of fact, the necessity for this alignment is

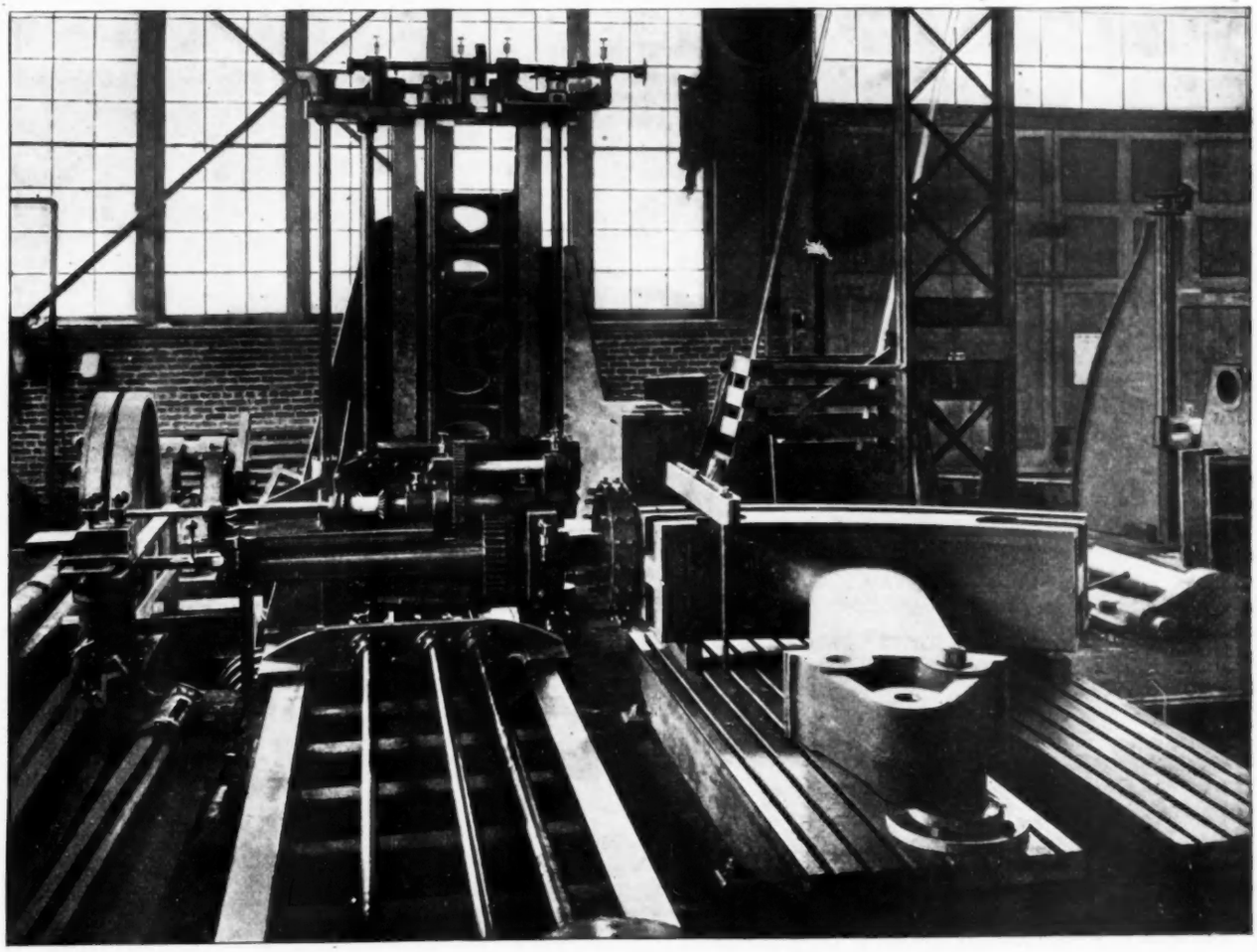


Fig. 1. MILLING THE JOINT.

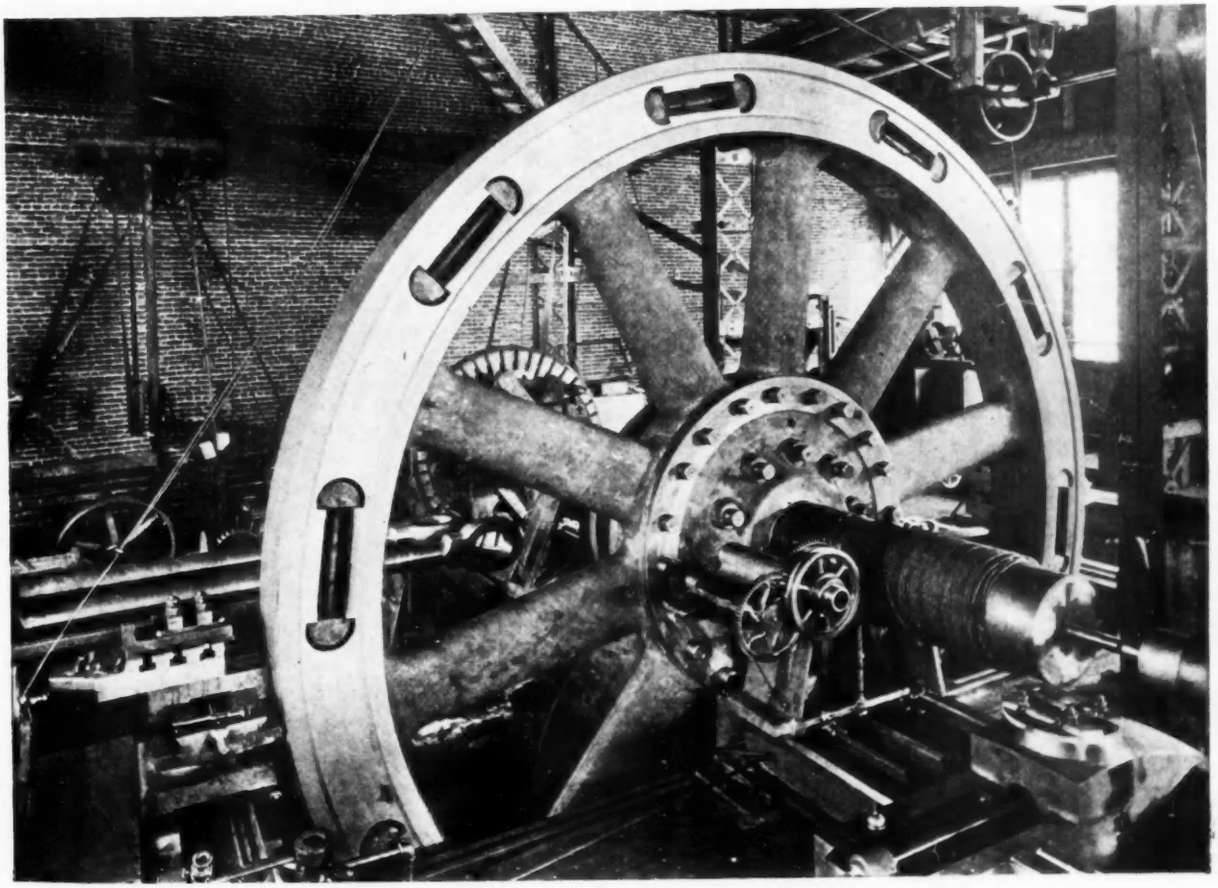


Fig. 2. A 100-TON FLY-WHEEL IN THE LATHE.

obviated by the use of an equalizing driver between the face plate of the lathe and the end of the shaft. This equalizing driver will be seen upon the face plate and through the arms of the wheel in Fig. 2, but its construction will be more apparent from the outline drawing, Fig. 3, in which *a* is a two-armed spider secured to and driving the shaft; *b* is the face plate of the lathe, and *c* is an intermediate floating or equalizing piece driven by the face plate and in turn driving the spider. Two links, *d e*, connect the face plate with the floating piece while two others, *f g*, connect the latter with the spider. It will be seen that this construction provides for any slight lack of alignment, and drives the shaft with a uniform turning effort and without side pressure in the bearings. To prevent end motion of the shaft, false or wabble centers are introduced between the lathe centers and the center holes in the ends of the shaft, one of which will be seen at the end of the shaft nearest the observer.

In operation the wheel is assembled piece by piece in the lathe. The shaft with the wheel center is first put in the lathe and the first segment put in place. The reaming attachment, which will be seen attached to the bearing which carries the shaft, is then brought into play, the bolt holes are reamed and the bolts put in place, this reaming attachment being driven by a rope drive from a small engine not seen in the illustration. After

Fig. 3

THE EQUALIZING DRIVER.

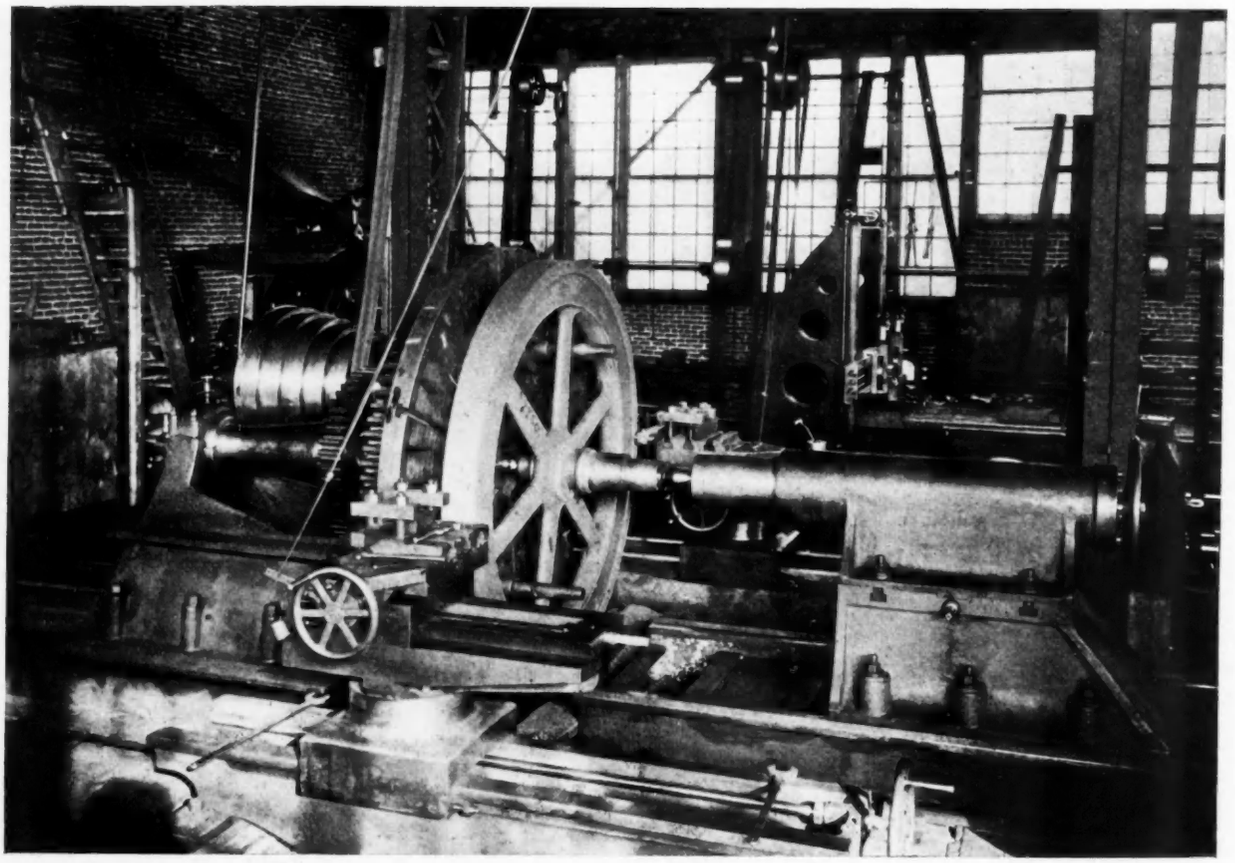


Fig. 4. PIT LATHE WITH GAP CLOSED UP.

the first segment is in place the others are added one at a time until the wheel is complete. The T-links shown in place are temporary ones used during the construction of the wheel only. They are, in fact, bolts having right and left threads, and are screwed into place warm, so as to get an effective grip on the work. After the wheel is finished it is taken down one segment at a time, no floor work being done on it. One of the advantages of this method is, of course, that the crane handling the work can be much smaller than would otherwise be necessary. The wheel shown in the picture is 24 feet in diameter and 100 long tons in weight, the section of the rim being approximately 24 inches square. The capacity of the lathe is such as to take in wheels up to 30 feet diameter by 7 feet face.

Fig. 4 shows the same lathe arranged for doing small work, the bed having been slid on the foundation to close the gap. Another arrangement, not shown in the picture, enables the hub to be bored or facing to be done.

It is needless to say that wheels so made run *true*.

▲ ▲ ▲

"Aerine," or Liquefied Air.*

BY EDWARD A. RIX.

While in New York, and during this past month of April, 1897, I have had the pleasure of witnessing some experiments and of experimenting myself with liquefied air, which I believe in the future is to be called "Aërine."

In one or two laboratories in Europe air has been liquefied in extremely small quantities, but nothing of importance has been learned of its properties or of its possibilities in physical or engineering economy.

On March 19, 1897, W. Hampson, of Glasgow, Scotland, announced that he had succeeded in liquefying air commercially, at a pressure of eighty-seven atmospheres. A telegram in one of the New York papers about April 1, 1897, announces that Professor Linde, of Germany, has succeeded in liquefying air commercially and producing it at a very small price per cubic foot. How long previously to the announcement of the success of these experiments these gentlemen had perfected their apparatus I know not, but I believe that Mr. Charles E. Tripler, of New York, more than twelve months ago, and possibly longer, succeeded in accomplishing the same thing. Probably to him is due the honor of being the pioneer in this proposition. The secrecy which was imposed upon me when I first witnessed these experiments has by special request and for the purpose of this particular occasion been somewhat lightened, and I am permitted to speak in general on the subject.

I look upon the commercial production of aërine as a very important discovery, and I think the future question of economy in motive power is intimately associated with this liquid. Compressed air, at pressures ranging from 1,000 pounds upward, is conducted from an air receiver through a small pipe, is refrigerated to expel its moisture, and is then conducted into the apparatus which liquefies it completely, without the use of chemicals of any kind, and it flows from this apparatus in a stream about the size of a lead pencil (in the apparatus which I saw) into a glass insulated receptacle, containing about two gallons. I saw this receptacle filled in a very short time. Of course, being in an open vessel aërine has no pressure, but its temperature is approximately —385° Fahr., or 445 degrees below the atmosphere at 60° Fahr. Inasmuch as it is boiling rapidly on the surface, owing to its absorption of heat from the atmosphere, it looks like carbonated milk, but upon dipping some of it out in a glass and observing its color through the glass, it has very much the appearance of ordinary water, and about the same weight. Its temperature is very deceptive, for as it runs from the condenser one may allow it to trickle over the fingers for a short space of time, and it appears to have the atmospheric temperature. The truth, however, of the matter is that it does not come in contact with the fingers at all; the hand being somewhat like 480 degrees warmer than the liquid, it throws the liquid into a spheroidal state and interposes between it and the finger a film of atmospheric air. The sensation is very much like pushing one's hand into a bag of feathers or into a mercury bath, allowing of course, for the difference in weight between the mercury and the aërine. If, however, you immersed your hand in the liquid a sufficient time to establish a contact, the flesh would be burned, the same as if it were exposed to 440 degrees of heat, measured above the atmospheric temperature. If a test tube of 1½ inches diameter, having a couple of pounds of mercury in the bottom, is immersed in aërine, the mercury will be frozen solid in a few seconds, and may be hammered out and otherwise manipulated the same as lead. An alcohol thermometer of large size will be frozen instantly upon being immersed in the liquid.

An idea of the tremendously low range of temperature may be gathered from the fact that it will take several minutes to thaw out the small bulb of this thermometer by covering it with the palm of the hand. That is one of the peculiarities of these substances, which I noticed at these low temperatures, that the surfaces of these frozen substances were not sufficiently large to absorb the heat fast enough to restore their condition, except after a considerable length of time.

A tablespoonful of aërine poured on about a fluid ounce of whiskey will freeze it at once into flat scales, giving the whole the appearance and color of cyanide of potassium. This may be emptied out on a table, and will remain frozen in that condition for fully five minutes.

One thing that impressed me was that while all molecular motion was practically arrested at this temperature, the odor was perfectly distinct, showing that these particles which stimulate the sense of smell are actively independent of the temperature.

A teacupful of aërine poured on top of a tank of cold water goes into its spheroidal state instantly, in globules of about half the size of an ordinary marble, which fly around on the surface, leaving a trail of white vapor behind them.

A handkerchief of either silk, linen or cotton, saturated with the liquid, will be charred and destroyed just the same as if it were put in an oven and browned, though no change of color is apparent. Its evaporation is quite slow and it may be carried about for a number of hours in an open vessel without entirely disappearing. It probably represents a compression of about seven hundred atmospheres, and would, therefore, in a confined space, and at 60 degrees temperature, represent a pressure of somewhere from ten to twelve thousand pounds to the square inch.

Of course, it is rather disappointing to have our ideas of absolute zero completely upset. While we have always appreciated the fact that it was a purely theoretical conception, and while it was perfectly possible to think of a point where air would have no pressure, it was not possible to think of its having no volume. Still, not being able to prove to the contrary, we have accepted the absolute zero as a possible reality. Of course, this has all been based upon the proposition that air was a permanent gas. In experiments, however, of the kind that I have just alluded to, we find that at a temperature of —385, air changes its physical state, yields up its latent heat and becomes a liquid, bringing into play a new series of phenomena which are not at all consistent with the equations which we have depended upon. At about —425 it becomes a solid, after which we know of no means of further changing its state, so that —461, the absolute zero, is an impossibility both in conception and realization.

Just what aërine has to do with thermodynamics I must leave you at present to conjecture, for I am not permitted to say, but I know of some and look for many other remarkable developments.

▲ ▲ ▲

More than 200 men employed by the Metropolitan Street Railway Company of New York City are now receiving an extra compensation of 25 cents per day because no complaint against them was made by either passengers or officers during the past year.

* Conclusion of a lecture delivered to the engineering students of the Leland Stanford, Junior, University, May 3, 1897.

Facing Nuts True.

In the average machine shop, and in many shops that are above the average, there is still some carelessness as to the proper facing of the nuts which are used. No one, of course, needs to be told that the face of the nut should be true, but there are very many nuts constantly being used that are not true. The first machine operation upon the nut is almost invariably the tapping of the hole. Sometimes a drill is run through the hole first, but that does not change the situation. The tapping is practically never true with the face of the nut. The face also is rough and crooked or irregular of itself. The nut may be screwed upon an arbor, the thread and also the shoulder of which may be true, but when the nut fetches up against the shoulder, the face of it being untrue, the nut must be tipped upon the thread and consequently cannot be faced true with the thread. After the first side is faced untrue, the other side will be faced parallel with it, and neither will be true.

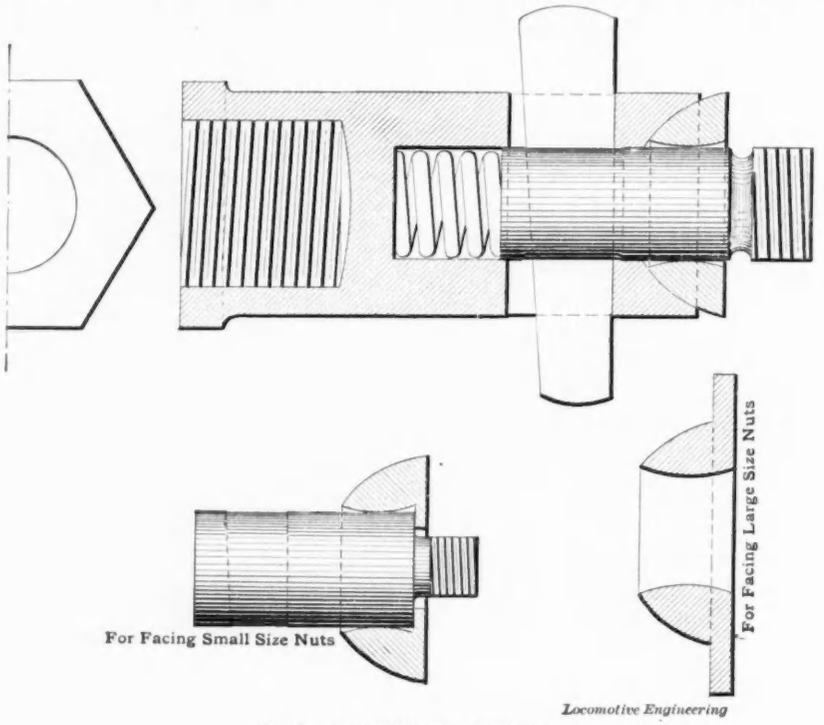


Fig. 1. NUT-FACING CHUCK.

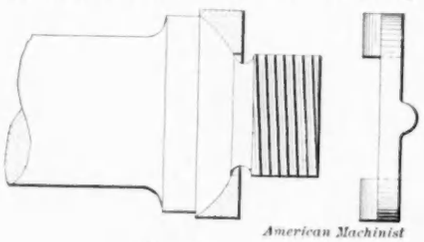


Fig. 2 Fig. 3

FOR FACING NUTS TRUE.

The chuck shown herewith, Fig. 1, which we take from "Locomotive Engineering," was designed by Mr. A. J. Kline, foreman at the Meadows shops of the Pennsylvania Railroad. It seems to provide all that is required for facing nuts true. The stock screws upon the lathe spindle and may probably hold two or three sizes of nut arbors, say ⅞ to 1⅛. The washer with the spherical back, of course, accommodates itself to the untrue face of the nut so that it will be able to bear properly upon the thread all the way round. The little helical spring keeps the arbor always pushed out against the edge of the key, or takes up the slack. The nut is screwed against the spherical backed washer with the key pushed in, and when the nut is faced a slight tap on the small end of the key will release the nut so that it can be run off by the fingers. A tight fit is not required for the thread with this arrangement. There might be a little gib hook upon the front edge of the small end of the key so that it would not drop out when backed. The spherical backed washer being loose there may be a little possibility of dirt or chips getting behind it, but even then it would still be pretty sure to bring the nut true.

It is so easy to provide means for getting the nuts true that there is really no excuse for having them otherwise. The nut arbor may be made as in Fig. 2, with the spherical bearing just the reverse of that shown in Fig. 1, and without the key business, and it will still face the nuts true. Or the arbor may be made with a square shoulder and a washer with a raised rib upon each face, Fig. 3, may be used for the nut to pitch up against, one of the ribs being at right angles to the other so that the nut would be able to tip in any direction to accommodate itself to the thread. After the first side was faced true these precautions or devices need not be used for the second side.

Letters from Practical Men.

Rolls and Rolling Mills—A Shop Discussion.

Editor American Machinist:

I send you a few notes of an informal lecture which was given on the above subject by our superintendent, Mr. Frank Mossberg, to the shop foremen and as many of the employés as saw fit to attend. All were cordially invited, and a large number availed themselves of the opportunity to be present. It was one of the first of a series of talks, or lectures, given by Mr. Mossberg, the idea being to take up each type of machine manufactured by the company, and show the use, and also abuse, that this machine is subjected to.

The meeting was held in the room for finished stock, on the upper floor of the factory. A medium-sized rolling mill, or, as the boys call it, a 4 x 6 mill, fitted with roller bearings, was belted up for the occasion. The first part of the time was devoted to actual experiments with the mill by rolling down a piece of sheet metal, and showing how distortion of the metal was caused by improper setting of the rolls, and also how the same could be corrected by proper handling of the same.

The rolls were then set together as tight as possible, and a piece of britannia metal, about 2 feet by 2 inches and .050 thick, was fed into the rolls, and as it came through on the other side, was reduced in thickness to about .001. The mill was running slow, probably not over 10 feet per minute, and as the stock was reduced in gage to one-fifth of the original thickness, a better illustration of the flowage of metal is seldom seen; as on one side of the roll it was coming away at a speed of about 10 feet per minute, while on the opposite side it was entering at the rate of one-fiftieth of that speed.

A number of samples of plate were then exhibited, showing how work which was really the result of bad rolling would be laid to the rolls themselves. Another sample was exhibited, showing at regular intervals a depression in the rolled metal, which was clearly the result of a small bunch or projection on the rolls, notwithstanding that the same had been carefully ground and lapped in the universal grinder. This was the result, as explained by Mr. Mossberg, of a blow being struck on the roll with a hammer (which, by the way, is one of the tests used to ascertain the degree of hardness given to the roll by the tempering process), and which made itself evident by swelling out after the roll had been carefully ground to size: very much as a blow struck into a piece of wood might swell out after the surface had been planed down to remove all appearance of the same. This may be a pretty hard thing for some of the readers to believe, but if they ever have the pleas-

ure of regrinding, at their own expense, a pair of rolls which have this fault, it may help them materially to believe it.

The methods of testing the pressure borne by the rolls when used on sheet metal were then explained, showing that the roller bearings with which the mill is fitted, often stand a pressure of 20,000 pounds per square inch of the projected area of the journal. The various parts of the machine were then gone over in detail, as the housing, wobblers, and also the advantage of the spiral, or, as it is usually called, the "herring-bone" style of gearing.

The method of rolling gold-plated stock was then explained; the workmen taking an ingot of brass composition, say, 4 x 12 inches by 15-16 inch thick, and a rolled-gold plate of equal size and about 1-16 inch thick. These are mechanically cleaned, and after they have been so prepared, nothing is allowed to touch the surface of either gold or brass composition. The two metals are then placed in close contact and are held by platers' clamps, while the silver solder, which is really a fine silver meal, is placed along the edge, and a brazing heat is taken on the whole; it is then taken to the rolls and reduced to whatever thickness may be desired; but no matter what that thickness may be, the proportion of 16 to 1 (this is no argument in favor of silver) will be maintained. The gold plate is often rolled down to, say, .010 thick, which would make the thickness of the gold less than .001.

The difficulties of making large hardened rolls for silversmiths' work were then touched upon, as well as the method of casting and finishing chilled rolls, it being impracticable to successfully harden and finish rolls of cast steel of over 12 or 14 inches diameter. By the way, if any of your readers have any information on this subject, I should be pleased to hear from them.

The employés were then cordially invited either to ask for any information which had not been given, or to make any suggestions as to better methods of tempering the rolls, or testing the hardness of those which had been through the process.

In answer to an inquiry from one of the foremen, as to the best test which could be had to show if the rolls were properly hardened, Mr. Mossberg said, to get them of a sufficient hardness to suit the roller was a very difficult matter, and in spite of the utmost care, soft spots will be found in the roll which will not show up until the same has been in actual use. (I would like to hear through these columns from any roller who has experienced this particular trouble, and if he has found any certain way of remedying the same just let him tell us how it is done.)

One of the workmen then took the floor, and described in a graphic manner some of the disadvantages met with in using the rolls in the shop, and how the same might be overcome.

At the conclusion of the lecture, a vote of thanks was tendered Mr. Mossberg for the information he had given in his inimitable manner.

I think that meetings of this kind, where employer and employés meet on equal ground, must invariably result in a harmony of feeling and good-fellowship which, I am sorry to say, is but too seldom met with in large manufacturing establishments.

J. L. LUCAS,
With the Mossberg & Granville Mfg. Co.

▲ ▲ ▲

Horse-Power and Time.

Editor American Machinist:

Allow me to call your attention to a mistake you have made in answering Question No. 75, second section.

You say, "And if the work were done in one minute, it would represent

$$\frac{443520}{33000} = 13.42 \text{ horse power};$$

if the work were done in one hour, then the horse-power would be

$$\frac{13.42}{60} = .223."$$

This is radically wrong, as you have already used the factor, time, in dividing by 33,000 foot-pounds, which represents one horse-power, according to the accepted form: One horse-power=33,000 pounds raised one foot in one minute, or 33,000 foot-pounds. The factor, time, is embodied in your divisor (33,000 foot-pounds) and it is wholly unwarranted to use it a second time.

The horse-power of the problem in question is 13.42, whether for one second or for one year.

Your error is in considering horse-power as the unit of quantity of work, instead of the unit of rate at which work is done.

HENRY E. FISHER.

[The question referred to, it will be remembered, was as to the work that could be done by a certain volume of compressed air at a given pressure, and it was computed that the work would be 443,520 foot-pounds, and this would be 13.42 horse-power for one minute, which our correspondent kindly concludes is all right. Now, dropping the decimal and calling it 13 horse-power, and changing the train of mechanism so that a single horse could do the same amount of work in 13 minutes, would it be proper to call the single horse a 13 horse-power horse or to say that he exerted 13 horse-power? Suppose that by the application of an additional or a different train of mechanism a man was enabled to do the same amount of work in two hours, would it be proper to call that man a 13 horse-power man, or to say that he exerted 13 horse-power? It really looks to us as if our answer was correct.—Ed.]

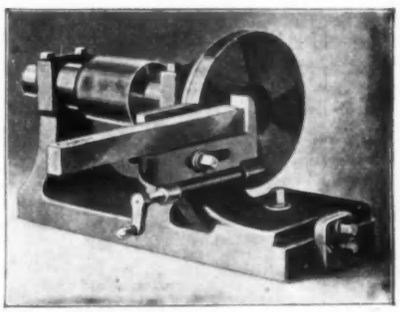
A Special Mechanical Movement Wanted.

Editor American Machinist:

I would be very glad if any of your readers could suggest some satisfactory means by which I can produce the following movement. I have a number of points arranged along a straight line ⅛ inch apart, and I want to extend them as wide as ½ inch apart, the distance between the points to remain equal, and the points always to be in a straight line for the entire distance. H. E. C.

[It seems to be well to submit this question to our readers. The lazy tongs movement will doubtless occur to many, but some one may be able to suggest something better.—Ed.]

▲ ▲ ▲



A Surface Milling Cutter.

The half-tone, from an old photograph, shows a surfacing milling cutter designed about a score of years ago by Mr. Francis H. Richards, of Hartford, Conn., the prolific inventor of tools and mechanical devices. Since its invention it, or cutters of the same type, have been in constant and satisfactory use for a special line of work. The cutter shown is about 8 inches diameter, and the cutting face is made, as shown, of eight similar sectors. These are about an inch thick and each is held to the central hub by a tap bolt from the back, the tapped hole in the steel coming, say three-quarters through it. The radial edges of the sectors butt together and, of course, support each other all around. It will be noticed that no cutting tooth upon either sector is radial, and, as all the teeth upon each sector are parallel, no two of them are at the same angle to the radial, so no chattering or waviness can appear upon the surface cut. A simple little rig being employed to hold the teeth parallel in the grinding machine, it is a simple matter to resharpen the cutter. The sectors are, of course, removed from the hub when this is done.

▲ ▲ ▲

Mr. C. A. Johnson, general manager of the Gisholt Machine Company, Madison, Wis., sailed for Europe on Wednesday, May 26th.

▲ ▲ ▲

Mr. Joseph Flather, of Flather & Co., Nashua, N. H., sails from Boston on Saturday, the 29th, for a two months' trip abroad.

AMERICAN MACHINIST

Published Thursdays by

American Machinist Publishing Co.,
256 Broadway, New York.

John A. Hill, President and Treasurer.
C. A. Hansmann, Sec'y.

▲ ▲ ▲

Editorial Department.
Fred J. Miller, Chief.
Frank Richards,
F. A. Halsey,
Edward P. Buffet, } Associate Editors.

▲ ▲ ▲

Illustration Department.
A. L. Donnell, Chief.

▲ ▲ ▲

Advertising Department.
C. P. Day, Eastern Representative.
J. M. Wakeman, Western Representative.

▲ ▲ ▲

Space in advertising pages only is for sale.

We invite correspondence on subjects pertaining to machinery.

Name and address must always be given, though not necessarily published.

Communications for or relating to the reading columns should be addressed to the Editor. All business communications should be addressed to the Company.

Subscribers can have their mailing address changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.

▲ ▲ ▲

SUBSCRIPTION PRICE:

$3.00 a year in advance, postage prepaid in the United States, Canada and Mexico.

$4 00 a year to other countries, postage prepaid.

Entered at Post Office, New York, as second-class mail matter.

For Sale by Newsdealers, Everywhere.

No back numbers beyond 1896.

▲ ▲ ▲

Getting Advice for Nothing.

Not long ago the head of a prosperous manufacturing firm wrote to a mechanical engineer in whose judgment he had confidence, and who happened to be an acquaintance, but in no sense an intimate friend, saying that it was becoming necessary for them to get a new and larger boiler for the increasing needs of their prosperous and growing business, and asking which of two boilers of decidedly different types he would recommend—addressed and stamped envelope enclosed. The letter was promptly answered, showing which boiler was best under the circumstances, and giving reasons for the choice. The boiler recommended was adopted. The mechanical engineer received a letter of thanks, and that ended the matter.

As a matter of fact, the victims of this sort of thing are themselves responsible for it, and only they can apply the remedy. As long as such advice can be had for nothing, nothing will be the market price of it. The manufacturer above spoken of certainly would not have expected to receive professional advice from a lawyer or a doctor and pay for it with personal thanks only, and there is no reason why professional mechanical or engineering advice should be any cheaper. Engineering is as truly a learned profession as either law or physic; for equivalent knowledge and skill its acquisition costs certainly as much in time, money and brains and the special advice which the trained engineer or the mechanic of large experience is qualified to give should be valued and paid for accordingly. It is altogether too common to be able to get mechanical engineering advice without expecting to pay for it. Of course, no one values highly what is got for nothing. So far as a man can be successfully imposed upon, he is to that extent so much the less respected, and especially by the man who practices and profits by the imposition.

While we are sufficiently on record as constantly advocating a liberal policy in the matter of interchanging ideas and information bearing upon shop methods and practices between the men of the shops, we certainly do not wish to be understood as equally favoring the giving away of too much for nothing to the world at large. The practice, while evidently unprofitable, is also not only belittling, but distinctly demoralizing. Work squarely paid for is expected to be and usually is honestly and thoroughly done. Work that it is known can bring only thanks, and perhaps not that, will be turned off in the easiest way possible. Even conscience is not reliable unless paid for its services. Advice will be given without proper investigation of the facts; conclusions will be announced without sufficient data to warrant them. The man will suffer in reputation, and must deteriorate in habit and practice, while the stimulus of appreciation, as evidenced by just remuneration, would have an opposite and quickening and elevating power.

It is really the greater time required by the engineer for preparation and full equipment that acts to place him in the false position we are speaking of. The graduate of the law school or of the medical college can at once open his office and take his fee from his first caller and from each that comes after. The graduate with the title of M. E. very rarely indeed can at once open an office as a consulting engineer, but must usually work for years on a salary, and in this position he is quite likely to be successfully and continuously pumped for gratuitous advice or information. And besides the school graduates there are also those who are rising or who have risen from the ranks and still are qualifying for the highest positions of responsibility. There is no sharply defined point of departure which all will recognize as that from which professional standing may be reckoned, and so appreciation is slow to take definite form.

We believe it true in mechanical and engineering matters, if it is not indeed true everywhere, that good advice and correct information can only be furnished by those who know it to be good and correct, and who also know approximately the value of it, and knowing that value, justice to self, to the trade or profession and to the world should insist upon approximately adequate payment.

▲ ▲ ▲

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(82) R. E. W. Pittsburg, Pa., asks for instructions for making blueprint paper. A.—You will find this information given in detail in Question 30, which appeared in our Questions and Answers column of March 4th, this year.

(83) X. Y. Z., Buffalo, N. Y., asks if the United States or any other government has offered a premium for the invention of perpetual motion. A.—No; governments are not in such foolish business. Dismiss all thoughts of perpetual motion from your mind.

(84) "Inspector," Dayton, O., asks: Do gage manufacturers, either for themselves or for the general market, use a "high or low grade of carbon steel"? Also, are there any advantages in using "low-grade carbon steel," and, if so, what are they? A.—The question is a somewhat vague one, as gages are made for so many different purposes. As they are usually exposed to wear, at some point or all over, they, or some parts of them, usually require to be hardened, so that they must be made of high-carbon steel. The only advantage in using low-carbon steel is that it is usually cheaper and also more easily worked.

▲ ▲ ▲

The Hartford Meeting of the American Society of Mechanical Engineers.

The thirty-sixth meeting of the American Society of Mechanical Engineers was held in Unity Hall, Hartford, Conn., last week, being called to order by Chairman Billings, of the local committee, at 9 o'clock Tuesday evening. Mr. Billings spoke of the wonderful growth of the society since its meeting at Hartford 16 years ago. The address of welcome by Mayor Preston, and the reply thereto by President Warner, followed. President Warner's remarks were very happy, and referred especially to the fact that the products of Hartford factories are known in their several departments as the best. Following this, came an informal reception and conversazione, with refreshments, in the basement of the same building.

WEDNESDAY MORNING SESSION.

Wednesday morning's session opened with a business session, although little business was transacted. It was explained by President Warner that it was

the desire of the council that the business of the society be transacted, so far as possible, at the fall meeting in New York, as the large number of excursions to manufacturing plants about Hartford would occupy a good deal of time.

After the reading of the names of the newly elected members, Mr. Henning read a proposition to the society from the International Association for Unifying Testing Methods. At the Zurich conference on the unification of testing methods, held in 1895, and attended by Mr. Henning on behalf of the society, a paper was presented on the desirability of establishing uniform specifications and methods of inspection of metals, the object being to define materials in such a manner as to lead to the use of proper materials without hampering developments and improvements in metallurgy. After discussion, it was agreed that the matter should be laid before the society in printed form for further discussion and action at the fall meeting.

This completed the business session, and the reading of papers was taken up, the title of the first being:

Diagrams for Relative Strength of Gear Teeth.

BY FORREST R. JONES, MADISON, WIS.

The paper presents a number of diagrams to facilitate the determining of the sizes and pitches of gears which are suitable to withstand a known or assumed pressure. The assumption is made that the pressure is applied to the tooth at its top, uniformly distributed across the width of the gear face, and normal to the radial plane of the gear which passes through the center of the tooth. The relative values of the force so applied, the pitch, and the maximum fibre stress induced, are given in the diagrams.

A written discussion was presented by Professor Barr, calling attention to the omission of any factors for the velocity of the teeth, and for the change in strength due to variation in the number of teeth. He referred to Wilfred Lewis's well-known experiments and formula, and Messrs. Supplee and Kent did the same, the general tenor of the discussion being that the paper was rather antiquated in its methods and treatment. Reference was also made to the diagram by Mr. Hess, which we published last year, as being an embodiment in graphical form of Mr. Lewis's formula. Finally, it was resolved by vote to refer the matter to Mr. Lewis for elucidation. The discussion was continued by Mr. Hunt, who gave the practice of his firm in gears for hoisting engines—their pitches ranging from 1 to 3 inches. He contended, and showed by diagrams of broken teeth, that, beyond a certain point, increasing the face of gears does not increase their strength, and made the further observation that it is always the pinion which breaks. He referred to Mr. Longridge's opinions on short gear teeth, and said his firm had adopted that practice with excellent results, their proportions being:

Addendum = .2 pitch;

Didendum = .2 pitch;

$$\text{Clearance} = \frac{\text{pitch} + 1}{20};$$

Face of tooth = 2 × pitch + 1, or more if desired for greater durability;

Working load in pounds = 1,650 × pitch.

They use the involute profile, and believe it the best.

The usual discussion, which began, we suppose, with the first cog-wheel, and will probably never end so long as gears are made, on the question whether increasing the face of gears indefinitely does increase their strength, followed, being participated in by Mr. Oberlin Smith, Mr. Rockwood and Mr. Supplee. In this discussion cast and cut gears were discussed, to the disadvantage, from all points of view, of the latter. This brought out from Mr. Henning a statement of a method of making cast gears, which, though old, had been recently revived, with excellent results. The method, in brief, is to make the mold from a cut iron pattern, and then bake the mold with the pattern in it. The pattern is then drawn and the iron poured while the mold is still hot. The expansion of the iron pattern in baking the mold leaves it free when it is to be withdrawn, without any need of draft, and was also stated to practically neutralize the shrinkage of the iron and leave the gear of the same diameter as the pattern. These gears were stated to be in extensive use in printing-press work, where accurate gears are a necessity. In this work they replace cut gears, not only answering every purpose, but in many cases without the users of the presses suspecting them to be other than cut, as even the tool-marks on the pattern will show in the cast gear. In reply to a question, Mr. Henning stated that gears had been made in this manner up to 48 inches diameter.

On account of his extensive experience with gearing, the President called on past-President Fritz for a few remarks, and in replying, Mr. Fritz said that the conclusion to be drawn from his experience was, that gears should never be used if it could be helped. So far as the question of the influence of increasing the face was concerned, he said that when using wide-faced gears he always cut the face in halves and staggered the teeth.

Experiments in Boiler Bracing.

BY FRANCIS J. COLE, PATERSON, N. J.

This is a report of an investigation into the holding power, at different temperatures, of various styles of firebox crown stays, made by the writer for a prominent railroad company. The object aimed at was to test as nearly as possible under the conditions of actual service, and particularly to note the relative decrease of the holding power at high temperatures. Sixteen different styles of crown stays were made, the material used being mild steel. The specimens were heated in a small portable forge, close to a Riehle screw-testing machine, and the strain under which each gave out, and other particulars, are here recorded quite fully. A liberal supply of drawings and half-tones are also given. The writer's conclusions are: (1) That the center rows of the crown stays should have solid button heads or nuts to prevent pulling through if the crown sheet is overheated; (2) grooving or cutting out the first thread under the head should be avoided; (3) it is good to enlarge the end screwed in the crown sheet directly under the button head, making it slightly taper; (4) the argument that it is safer in radial stay boilers to omit heads on firebox ends and allow a few to pull through easily, so that in case of low water the fire will be put out and the pressure relieved, does not seem to hold good in practice; (5) as crown sheets are usually higher in front than behind and arched in the center, a few crown stays in the highest point should be left without heads or nuts; (6) it is better to face the sheet with a cutter than to use a copper washer, or to let the bolt bend under the head when it is tightened up.

In the discussion, Mr. Henning said that the materials used must have been very carelessly tested, some of the properties given being inconsistent with one another, and some of the combinations of properties being unknown in any existing material.

Mr. Hartness referred to the strains brought about by the pitch of long stay-bolts being different from the taps used in tapping the sheets, and said he had advocated the use of adjustable tandem dies—a separate die being used for the two ends of the bolt, locked together, but adjustable lengthwise of the bolt, the adjustment being made by the tap itself.

Adiabatics.

BY DE VOLSON WOOD.

This was a short paper, but quite mathematical, its purport being to show some new applications of old principles.

The paper was discussed by Mr. Richmond in a manner which won expressions of approval from all. He stated that the subject of adiabatics could be put in much simpler form than is usual, and without using any calculus, and showed on the blackboard what his methods are. On motion by Mr. Kent, a request was voted, amid applause, that Mr. Richmond present his treatment of the subject in a paper to the society.

Mr. Rockwood wanted to know of what use adiabatics are, anyway.

A New Form of Transmission Dynamometer.

BY FREDERICK BEDELL, ITHACA, N. Y.

The apparatus forming the subject of the paper has not been employed as a dynamometer, but has been used for some years in a different form in experiments

upon synchronous motors, so that the paper, instead of actually describing an existing dynamometer, is rather a suggestion of a design for one. The two shafts, from one to the other of which the power is transmitted, are in line and with their ends close together, with a spider on the end of each. These spiders are connected by suitable springs, which yield under the driving strain and allow a slight rotary movement of one spider relatively to the other. Each spider carries a large annular disk, and the two disks face each other and lie close together. Each disk has a number of inclined and slightly curved slots lying across it, the slots in the two disks being similar, but inclined in opposite directions. Where the slots of the two disks cross each other, there is a slight opening through which light may pass. As the disks turn in relation to each other, the point where the slots cross each other will be nearer to or farther from the center, and when revolving at considerable speed, a ring of light will be seen which will vary in diameter with the power transmitted.

The device is so extremely ingenious and simple, and of such obvious utility, that the reading of the paper was received with a round of applause.

Flue Gas Analysis in Boiler Tests.

BY R. S. HALE, BOSTON.

The paper describes the apparatus and process employed in analysing the escaping gases from boiler furnaces for the information and guidance they may be able to furnish in boiler management. The diagrams with the paper show the comparative rate of evaporation, temperature of gases above the fire, temperature of waste gases, percentage of $C O_2$ in gases, etc. It is shown that gas analysis may furnish an explanation of uneconomical performances; it will furnish a check on markedly erroneous performance; and it is further argued that, as gas analysis shows the boiler owner where his losses are, the gas analysis is a more important part of a boiler test than the analysis of the coal or the determination of its calorific power, which only shows how much his losses are.

Written discussions were presented by Professors Connelley and Carpenter, who advocated diametrically opposite views regarding the presence of carbonic oxide in boiler flue gases—the latter claiming that it was never found in amount beyond a trace, while the former claimed the opposite. Mr. Kent took part orally in the discussion, saying he had had occasion to make a number of such analyses recently, and his experience coincided with the first contention. The conclusion to be drawn from his statements was that, at present, accurate results in this work are impracticable. He also stated that the determination of the free oxygen in the gases was of primary importance, while the determination of carbonic acid alone was of very little value.

Hygrometric Properties of Coals.

BY PROF. R. C. CARPENTER, ITHACA, N. Y.

This paper describes a series of tests for the purpose of ascertaining the relative qualities of various coals with reference to absorbing moisture from the atmosphere. A great difference in the absorptive power of different coals was shown. The coking coals of Western Pennsylvania absorbed the least, then the anthracites, while the Western bituminous coals absorbed much more. The larger sizes of coal absorbed less than fine coal. In connection with the preliminary process of drying the samples of coal, which was done by heating for an hour to from 220 degrees to 240 degrees Fahr., it appeared incidentally that no loss of volatile matter from the coals occurs at temperatures below 300 degrees.

The discussion was opened by Mr. Hale, who differed from the author regarding the loss of volatile matter at temperatures of 300 degrees. Mr. Kent sustained Professor Carpenter's position, claiming that there is no such loss below 300 degrees, while temperatures of 240 degrees to 300 degrees are necessary to drive out the moisture. The paper was further discussed by Messrs. Henning and Oberlin Smith.

WEDNESDAY AFTERNOON.

Wednesday afternoon was devoted to visits to industrial establishments. An innovation was introduced in this matter which worked well. The meeting was divided into two parties; all having badge numbers below 150 forming one, and all above that number the other. The two parties visited different establishments, the arrangement being reversed on Thursday. The purpose of the arrangement was to avoid the inconvenience attending too large a number in a single delegation. The party to which the writer belonged went to the Pope Motor Carriage Works, the Hartford Rubber Works, the Pope Tube Works, and the Pratt & Whitney Works. At the motor carriage works much interest was shown, the carriages being shown in motion, and all visitors so desiring being given what was, to most of them, their first ride in such a carriage. The comments on the action of the carriages were very favorable. The carriages are electric, being driven by a storage battery. The length of run is thirty miles. The Pope Company do not believe that the gasoline engine carriage is at present within sight of success.

At the rubber works, which make the tires used on the "Columbia" bicycles, and also at the tube works, the interest shown was very great, as the operations were, to most of the visitors, new.

WEDNESDAY EVENING.

On Wednesday evening a general reception tendered the Society by Trinity College in Alumni Hall was largely attended and highly enjoyed.

THURSDAY MORNING SESSION.

This morning's session opened with the reading of two papers which were discussed together, the first being:

Electricity versus Shafting in the Machine Shop.

BY CHAS. H. BENJAMIN, CLEVELAND, O.

This paper considers only the applicability of electrical transmission in the machine shop, and is properly supplementary to a previous paper by the same author, read at the last December meeting. Tables are given, showing costs of application and estimated savings under various conditions. Attention is called to the fact that, after all, the question of advantage and desirability hinges not upon efficiency of transmission, but upon the effect on the output of product per man and per machine. After the question of mechanical efficiency is disposed of, there are such considerations as the following to be attended to: Arrangement of machinery to facilitate handling work, clear head-room for cranes and hoists, light and cleanliness, control of speed, general flexibility of the system, and the applicability of the electricity for other purposes. These are generally discussed, and some suggestions are offered as to the style of motors to be employed.

Following this came:

Electrical Power Equipment for General Factory Purposes.

BY DUGALD C. JACKSON, MADISON, WIS.

This paper speaks first of the rapid and now extensive application of electric power distribution in manufacturing establishments. It gives a typical list of ten concerns using over 500 horse-power of electric motors in their power equipments; also another list of ten firms having over 100 horse-power each. It then discusses the relative cost and advantages of electrical and mechanical power distribution. The first cost of electrical transmission is usually considerably greater than the first cost of mechanical transmission. When a change is made from mechanical to electrical transmission, the material thrown out by the change is an additional charge against the electrical plant. The advantages of the contrasted systems are then considered. These cannot be satisfactorily enumerated here. The electrical system is shown to be much preferable for most manufacturing concerns using 100 horse-power or over. Separate motors for individual machines are not favored for those requiring less than 5 to 7½ horse-power. Small lines of shaft and motors from 3 to 15 horse-power are recommended.

These papers were discussed at length,

and at the start the motor-to-each-tool men had it all their own way, but before the discussion was closed it was made clear that belting and shafting still have some use. Mr. Rockwood mentioned several concerns that had adopted electric driving unwisely, bankruptcy following in some cases in consequence of the mistake. He thought the least useful place for the electric motor to be in a machine shop. He likened the enthusiasm of the motor advocates to that of the high-speed engine advocates of twenty years ago, and said that the motor, like the high-speed engine, would be found to have its field, but that it was not of the universal use which its advocates claimed. Mr. Stetson followed with some well-chosen remarks drawn from his own experience, and pointed out the microscopic nature of some of the sources of saving urged. He considered it settled that in a case like that of the works of the General Electric Company, with many buildings covering a large area, the electric system of power distribution is the best, and that, on the other hand, in a case like that of the Waltham Watch Works, individual motors had no place. The dividing line comes somewhere between.

On invitation from the President, Mr. Smith Whaley outlined some comparative results obtained in two cotton mills of approximately the same size, one being fitted with shafting and the other with motors, and promised to lay more detailed information before the society in the near future. Following this came a paper on

Volumnar Contraction of Castings in Cooling.

BY FRANCIS SCHUMANN, PHILADELPHIA.

This paper is simply an addition to a paper, by the same author, presented at the December meeting. It received no discussion, and was followed by

The Laws of Cylinder Condensation.

BY ARTHUR L. RICE, BROOKLYN, N. Y.

The paper is a formal discussion of the subject of cylinder condensation, of the circumstances attendant, of the losses resulting, and of the factors that control it. Numerous diagrams and tables are presented from the records of different investigators of this important subject. A formula for estimating steam condensation is also given, and computations, by means of the formula, are compared with actual test data.

Mr. Lockwood doubted the accuracy of the resulting formula, and Mr. Kent criticised the arrangement of the paper, saying he had had to search through it in detail to find certain facts which should be so placed as to be found without loss of time. He thought the formula should be put in better shape for application to a given engine, and that a résumé of the conclusions should be added. The next paper was

Tests of Three Sulzer Engines.

BY HAMILTON A. HILL, BOSTON, MASS.

The paper is made up of reports furnished by Mr. Carl Sulzer, of Winterthur, Switzerland. Mr. Sulzer is a member of the society and one of the firm of Sulzer Brothers (Gebruder Sulzer), said in the paper to be the largest establishment building stationary steam engines in the world. The engines dealt with in the paper were a vertical triple-expansion engine of 1,300 horse-power, a horizontal triple-expansion engine of 2,000 to 2,500 horse-power, and a smaller engine of the same type. The steam consumption shown went below 11 pounds per horse-power. The paper is liberally illustrated, the dimensions on the drawings, by the way, being all metrical. The engines have double-seat poppet valves and liberating gear. The valves are claimed by the makers to be and to remain tight.

In the discussion, Mr. Lockwood congratulated the society on the possession of the drawings included in the paper. He referred especially to the use of poppet valves, and said that undoubtedly the use of such valves had been hindered in this country by the overshadowing influence of Mr. Corliss. He considered the double-seat poppet valve to be eminently suited to the high pressures of today. He doubted the extreme figures of economy claimed, and called attention to the fact of a high vacuum being used in all recent tests showing the best results—disproving the theory that a high vacuum is destructive to economy by its refrigerating effect.

Professor Jacobus wanted to know who made the tests, and stated that analyses by Professor Denton and himself showed that the final economy of compound and triple-expansion engines was about the same when the interest on the investment was considered. Mr. Supplee described the magnificent works of Sulzer Bros., as seen by him recently, and stated that about half the machine tools were of American make, while probably half the remainder were European-made copies of American tools.

The concluding paper of the session was

A Method of Shop Accounting to Determine Shop Cost and Minimum Selling Price.

BY H. M. LANE, CINCINNATI, O.

The author of this paper, supplementary to a more extended paper upon the same topic, read at the December meeting, has been in correspondence with the heads of about forty concerns upon the subject. By selecting and re-grouping from the best practice those features which seem most desirable, the shop cost is assumed as the sum of: (1) Producer's labor; (2) cost of material, including freight, etc.; (3) plant charge, and (4) burden. The plant charge is an hourly charge, in addition to charge for operator, and includes interest and depreciation, the tool's cost for power distribution. The "burden," suggested by Fraser & Chalmers, is the sum of all expense chargeable to the shop except producer's labor and material. The total for any given period, divided by the number of producer hours for the same period, gives the hourly burden or the number of cents to be added to each producer hour. These four items give the cost up to the office door, and then a percentage is to be added for office and selling expenses.

The discussion of this paper was long, but rambling, and did not in fact relate, except remotely, to Mr. Lane's special plan. Mr. Hunt pointed out the error of the common practice of charging all the expense item against labor, and insisted on the necessity of dividing the charge between material and labor. This had been forced to his attention by the large portion of their business, in which material left them practically as it was received.

THURSDAY AFTERNOON.

The afternoon of Thursday, like that of Wednesday was devoted to shop visits, the party being divided into sections in the manner already explained. The writer's party visited the Columbia Bicycle works and the works of the Billings and Spencer Co. The testing room of the former was a center of interest, especially the special appliances for testing the finished frame and wheels. In both cases a load representing a rider of more than average weight is applied, and strains representing as closely as possible those experienced in riding over a rough road are applied. In the case of the frame, the wheels are removed and the front fork is rigidly supported. By means of a short crank the rear fork is rapidly elevated and depressed, and by two similar cranks the alternation of pressure on the two pedals is reproduced on the crank hanger. The frames are tested to destruction, the number of turns of the shafts before failure, being about 150,000. Failure usually occurs in the upper member of the frame, about two inches behind the stearing head. The wheels are revolved by a revolving drum on which they rest, the drum having cleats attached representing obstructions in the road.

THURSDAY EVENING SESSION.

This was devoted to a lecture on paper, with lantern illustrations on the screen, describing the

History and Development of the Bicycle.

BY LEONARD WALDO.

The paper may be fairly described as a piece of bicycle worship, the machine being represented as the culmination of man's hopes and aspirations since he began to have either, as the crowning achievement of the race and as embodying in its construction a combined know-

ledge of the leading arts and sciences, to which we can only say, fudge! The writer rides a wheel, but had before supposed this state of ecstacy over it to be confined to the newly rich in mechanical knowledge, whose education in such matters is confined to what the wheel has given them. A number of lantern slides of early wheels were shown, one which appeared 150 years ago being, except for the chain which was replaced by connecting rods, practically on the lines of the present standard safety machine. Extracts from old writings were read which showed that enthusiasts on the subject are not an exclusive product of the present century. Some excellent illustrations of leading details were also shown. The lecture was of course largely intended as a piece of recreation—including that of the ladies—for which purpose it was a success. We do not imagine it is intended to be given a permanent place in the transactions.

FRIDAY MORNING SESSION.

The opening paper of the session was

On Rating Electric Power Plants Upon the Heat-Unit Standard.

BY WM. S. ALDRICH, MORGANTOWN, W. VA.

The paper assumes that in the case of an electric plant there should be guaranteed a definite output expressed in kilowatts per 1,000,000 B. T. U., supplied to the steam used in the whole plant. The advantages enumerated are: 1, It is a simple basis, involving quantities easily measured; 2, It applies to all plants operated by any kind of heat engine; 3, it forms the most satisfactory basis for comparison of plants; 4, It will facilitate the predetermination of the performance of electric power plants; 5, It will provide the most economical arrangement of plants; 6, Heat-unit specifications will form a proper basis of agreements; 7, Contract trials for electric plants should be based on heat-units; 8, It will advance this industry along engineering lines. It is agreed that the stating of the electric performance in kilowatts per pound of coal, or given quantity of other fuel, necessarily involves individual fuel valves and boiler performances, while the proposed system begins beyond, and is independent of, these conditions, and confines itself entirely to the electrical performance which it is proposed to measure. Electric plants as well as steam pumping plants should both employ the heat unit rather than the fuel consumption as the measure of efficiency.

Written discussions were presented by Messrs. Porter and Randolph, the former of whom endorsed the paper as a step in the right direction, while the latter thought that the input should by rights be measured from the heat units of the coal, although he recognized the difficulties in the way, and concluded that for the present the engine should be separated from the boiler and be charged with the heat units of the steam. Mr. Kent thought the boiler should be included in the guarantee, and closed with a characteristic piece of advice to the author for the improvement of his paper.

The next paper read was

Current Practice in Engine Proportions.

BY JOHN H. BARR, ITHACA, N. Y.

This valuable paper by Professor Barr represents a vast amount of labor, both in the collection of the data and in condensing and arranging it and putting it in form for presentation to the society. A form with spaces for over fifty items relating to the proportions of parts of engines was sent to engine builders, and many of them filled in the data for from three to sixteen sizes of their engines. The material collected covers about 200 engines from 20 to 250 horse-power. This material was separated and classified, and diagrams have been prepared for the different details showing the range of dimensions and the mean of accepted practice. Such particulars as thickness of cylinder walls, flanges and heads, studs, ports and pipes, face of pistons, piston rods, connecting rods, and so on all through the engine, are successively considered.

The discussion consisted mainly of expressions of approval and some questions to which the author replied in closing. Of the paper it is mild praise to say that it embodies the best collection of data on steam-engine proportions that has ever been collected. It should, as it no doubt largely will, supplant the collection of rules and formulas which now occupy the pages of our pocket books. Following this came

A Continuous Steam-Engine Indicator.

BY THOMAS GRAY, TERRE HAUTE, IND.

The instrument described was first devised for obtaining the record of a gas engine, where its desirability must be especially evident. The most important feature of the instrument is in the means provided for moving the sheet or roll upon which the diagram is traced. Instead of a uniform continuous motion, this strip of paper, although moving constantly in the same direction, is given a motion corresponding in velocity with the piston movement. A sketch and description of the mechanism by which this is accomplished is given in the paper, and several interesting continuous diagrams, one from a New York and St. Louis express train and one from an engine driving a street railway plant.

For the discussion Mr. Carey read a description, illustrating the same with blackboard sketches, of the Amsler continuous engine integrator, which does not draw an indicator card, but continuously sums up the work done by an engine, stroke by stroke, and gives the results upon a dial. A sample instrument was passed around. Professor Jacobus described an attachment to the common type of indicator for converting it into a continuous instrument, and called attention to the absence in Professor Gray's instrument of a means of indicating the end of the stroke, which he pointed out was important, as one half of the length of the record represented negative work. Mr. Supplee referred to a continuous indicator used by Morin in the 40's. The next paper was on

A Mirror Extensometer.

BY GUS C. HENNING.

This paper described the instrument which was illustrated in our columns recently, the description going into the mathematics of the instrument more fully than the article in our columns, and also replying to some criticisms which that article had brought out. High appreciation of the instrument was expressed in the discussion. The session was concluded by taking up the Topical Discussions and Notes of Experience, several subjects for discussion with observations having been presented, the first being on

Steam Distribution at Early Cut-Off.

BY E. J. ARMSTRONG.

These notes give results obtained on the testing floor, and outline a change in steam distribution intended to take advantage of them. These results show that at very early points of cut-off the steam economy is increased by some throttling of the steam, and Mr. Armstrong has recently modified his valve gear to produce such throttling. He gives some indicator cards taken under varying loads, which show the action very clearly. No discussion was brought out on this topic.

Tests of the Efficiency of the Bicycle.

BY J. G. D. MACK.

Diagrams showing the efficiency curves of high, medium and low grade wheels are shown, and the apparatus by which they were obtained described. The high grade wheel under the best conditions showed an efficiency of 92 per cent., that of the medium grade being about 10 per cent. less, and that of the cheap wheel about 10 per cent. still less. Professor Carpenter submitted a written discussion, saying that his own similar experiments had shown that the chief loss was in the tire—this loss being 3-4 times more than all the others added together.

Basement Floors for Machine Shops.

BY JOHN. E. SWEET.

Professor Sweet believes that a layer of thin flat stone with enough concrete to bring the total thickness up to 6 inches is better than 6 inches of concrete alone, that a coat of asphalt is best to cut off moisture, that a layer of 2-inch plank is better than scantlings, and that the top floor should not be over 7/8 thick, as it leaves more shallow holes when repairs are necessary. Mr. Woodbury presented a

valuable contribution to the discussion, which was too long to reproduce here.

FRIDAY AFTERNOON EXCURSION.

The afternoon of Friday was given to a sail down the Connecticut River to the brown-stone quarries, of the Brainerd, Shailer & Hall Quarry Co., at Portland. On the return, the works of the Berlin Iron Bridge Co. were visited and a stop made at the new electric power house of the Western Division, of the New York & New England R. R., over which line the return trip was made in electrically driven cars. The distance of 9.3 miles was made —standing start—in 11 minutes 3 seconds, a portion of the distance being made at the rate of 62 miles per hour.

FRIDAY EVENING SESSION.

The opening paper was on

A Pocket Recorder for Tests of Materials.

BY GUS C. HENNING.

This is an instrument that is designed for use upon any and all machines which have a running poise weight. It gives a complete record from the beginning to the end of a test and it has also the important feature of showing the more important events on an enlarged and the lesser events on a natural scale. While elongations within the elastic limit are very minute, and must be recorded on a magnified scale which is reliable, changes of length beyond this critical point are very large, rapid and variable. The change of scale required is in this instrument positive, controllable, and occurs at a fixed instant or point, and it introduces no errors in the record. Several diagrams or records of tests are given and explained.

A written discussion was presented by Professor Benjamin, which referred to an instrument of his own, and Professor Gray offered some complimentary remarks on the instrument.

The next two papers were read and discussed together:

The Effect of Alternate Positive and Negative Stress on Iron and Steel.

BY THOMAS GRAY, TERRE HAUTE, IND.

The paper embodies diagrams showing the results of tests upon specimens of cast iron, wrought iron and mild steel wherein the loads were applied alternately in opposite directions. Great difficulty was experienced in making the tests, on account of the inconvenience of the ordinary testing machine for this work. The tests are therefore only considered preliminary to a more extensive and thorough series to be conducted under more satisfactory conditions. The results, as might have been anticipated, show that the modulus of elasticity of the specimen for extension are changed by the compression, and that the change is to some extent retained after the material has been permanently elongated, but the change is still only temporary, and disappears after a period of rest.

The Yield Point of Iron and Steel.

BY THOMAS GRAY, TERRE HAUTE, IND.

The paper consists of several interesting diagrams and a few remarks upon them, all mainly illustrative of the kind of results which have been obtained with the autographic apparatus described by the author at the San Francisco meeting, the tests bearing on the peculiar behavior of iron and steel as they pass through the "yield point."

Discussing the first paper, Mr. Henning reported some tests of his own, which corroborated his own recorded results, and with regard to the second paper, he enlarged upon the necessity for distinguishing between the yield point and the elastic limit in all tests of materials.

The next two papers were also read together:

An Apparatus for Accurately Measuring Pressures of Ten Thousand Pounds Per Square Inch and Over.

BY PROF. D. S. JACOBUS, STEVENS INSTITUTE.

In this paper Professor Jacobus shows how simple and easy it may be to do a thing apparently very difficult when the proper device is selected. A simple vertical steel plug, half an inch in diameter, fits in a bushing one half of a thousandth of an inch larger, and the pressure is applied to raise the plug. On the upper end of the plug is a ball thrust bearing which bears against a fixture capable of sufficient resistance. A hand wheel, also upon the upper end of the plug, permits it to be turned so that the friction due to the movement up and down is eliminated. The apparatus is first balanced upon the platform of a common weighing scales, then when the pressure is applied the upward thrust of the plug becomes a downward thrust upon the platform, and from the weight indicated, in connection with the plug area, the pressure is easily computed.

Tests to Show the Influence of Moisture in Steam Economy of a Steam Turbine.

BY PROF. D. S. JACOBUS, STEVENS INSTITUTE.

The tests here reported were undertaken to prove or disprove the impression among engineers that the presence of a small amount of moisture might tend to improve the efficiency by increasing the density of the jets impinging against the wheel buckets. The tests showed that there was practically no difference in result whether dry or wet steam was used The paper describes the apparatus employed and embodies three interesting tables, the first giving the steam consumption per horse power hour, the mean being 68.7 pounds. The wheel used was 8⅝ inches diameter, the revolutions about 10,200 per minute, steam pressure 95 and mean horse power 1.45.

On these papers there was no discussion.

A paper on

The Best Load for the Compound Steam Engine.

BY A. K. MANSFIELD,

was on account of the absence of its author and of all who had sent in written discussions, read by title only.

This paper, by the well-known mechanical manager of the Buckeye Engine Company, suggests that more should be known not only of the actual performances of engines under certain known conditions, but of the relative economy under different conditions, so that the value of the changed conditions may be properly weighed. A diagram is given of tests of two compound condensing Buckeye engines, showing the weight of steam used for I. H. P. under different conditions of load, speed, cylinder ratios, clearances, etc. The lowest steam consumption shown was 15.4 pounds of steam for a cross compound 14 x 28 x 24 at 160 revolutions, no steam jacket or reheater. The diagrams will be of more value when more such diagrams are also on record for comparison.

Following this came the usual resolutions of thanks and adjournment. The meeting from all points of view was highly successful. The number of members and visitors registered at headquarters was 401, which for the spring meeting is the highest in the history of the society.

▲ ▲ ▲

Commercial Review.

NEW YORK, SATURDAY EVENING, MAY 29

MACHINISTS' SUPPLIES.

Summer is almost upon us, and although we have been preserved up to this time from hot and enervating weather, this and the various contemporaneous circumstances of the summer months are daily to be looked for; so it is little wonder, if trade displays something of the weaker tendency which is certain to characterize it between spring and fall. A considerable proportion of yesterday and the day before spent in conversation with representative mill and machinists' supply men of this city shows plainly enough that hope of a definite business improvement must be postponed until autumn.

The bicycle factories can hardly be looked to for supply orders at present, for they are winding up their season's work. Furnishers of bicycle frames, material, etc., have begun to think about next year's business. The cessation of bicycle manufacture in New England is apparent. Only a week ago one factory, for instance, let 500 men go, and were expected soon to dispense with 300 more. It is said that the cheaper wheels and the '96 models have sold better than the higher-grade cycles this year.

In regard to prices, the principal change of importance to machinists has been an increase in the discounts upon set and cap screws. They are now quoted at 70 and 10 per cent. for set screws, iron or steel, 60 and 10 per cent. for hexagon head cap screws, and 65 and 10 per cent. for square head cap screws. Twist drills, in which the competition is keen, have not suffered any general reduction of late. That bolts, since the bottom fell out of the combination, have been remorselessly hewed down in price is an old story. Pipe and fittings have been on the down grade.

POWER-TRANSMITTING MACHINERY.

A few leading manufacturers of power-transmitting machinery report that business is slightly improving. Although there are not many large orders, more work of this kind is on hand than there was some time ago. The May moving time did not, this year, occasion the amount of trade usually incident thereto, according to the experience of one concern. Another party remarked to us that he does not consider this a very important factor in business anyway, since the manufacturers changing their locations at that time are principally of the smaller kind, who rent upper stories and carry their machinery from one place to another when they move. However, he said a little flurry of orders was usually then noticeable.

At the factory of P. Pryibil, in this city, we are informed that a line of work notably on hand is large shafting, 6, 7 and 8 inch. They are executing a contract for rope transmission purposes in this locality. They believe that appearances point to a fair amount of business in shafting, owing to the building season being open. They are also preparing to furnish sugar machinery to be used upon the next crop. Since the Cuban war has been on, Louisiana is one of the principal markets for what sugar machinery is still manufactured, and another source of demand, of course, is the Northern refineries.

The fact is also remarked by the above parties, that a considerable portion of the business in sight at present is in some way connected with electrical enterprises, and with this we may couple a remark made by Mr. F. A. Errington, manufacturer of a special line of tapping chucks, that about half of his recent business has been derived from similar sources.

MISCELLANEOUS REPORTS.

The Standard Tool Company, Cleveland, O., makers of chucks, drills, etc., inform us at their New York office that the course of trade during the past few months has been noticed by them as follows: March, best month in a long time; middle of April to middle of May, quieter; at present, more orders. The Arcade File Works, Anderson, Ind., manufacturers of increment cut files, have their customary force still employed, and are running on full time, in spite of the depressing influences of business generally.

J. F. Rogers & Co., who do a considerable Spanish American, as well as local supply and machinery trade, mention that they are on the point of closing contracts for two saw-mill plants, including the steam power machinery to drive them, and aggregating about $11,000 in value, to go to Nicaragua and Costa Rica. They shipped last week a 14 x 14 inch engine with boiler, for an Amazon River boat, and this week two 200 horse power National Water Tube boilers with Wilkinson automatic stokers to Cuba. Regarding the state of export business to Spanish American countries, they say that inquires are not as numerous as they

(Continued on page 35.)

▲ ▲ ▲

Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

Engine Castings ⅛ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Send $1 to the Tabor Mfg. Co., Elizabeth, N. J., for improved stop-motion revolution counter.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Cost of Manufacturing—Experienced manager will establish system of costs, giving exact account of every detail. Charge based on saving effected. Correspondence solicited. Geo. C. Thomas, 99 Nassau Street, New York, Room 212.

▲ ▲ ▲

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday Morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

By exp. draftsman and M. E. Box 32, Am. Mach.

On mch. wk., tools, or patterns. Box 29, Am. Mach.

Position by experienced man as layer-out in boiler works. Box 28, American Machinist.

Mech. draftsman, 3½ yrs. office, 4 yrs. shop, auto. and general mchy., wants pos. Box 34, Am. Mach.

Mech. draftsman and designer, tech. grad., exper. machinist, wants pos. Box 4, Amer. Machinist.

Machine designer, tech. graduate, 6 years' exp., wants to change. Address Box 3, Am. Machinist.

A thorough up-to-date mechanic, good manager, large exp. in shop mgnt., engs., light & heavy mach. tools and designer, wants pos. Box 33, Am. Mach.

Exp. machinist and draftsman, who has served as general foreman in different shops throughout the country, desires position as foreman or supt. Best of references. Box 216, American Machinist.

A party with a number of years' exp. in mfg. companies desires a situation as assistant to some mfg. co. Details and management of help pref. Ref. furn. Ad. M. W. C., P. O. Box 1829, Boston, Mass.

Toolmaker, first class on dies and tools, auto. mchy., mch. design, experimental, accustomed to fine, accurate work; foreman tool and mfg. dept. former place; 12 yrs. experience. Box 31, Am. Mach.

Export—Educated mech. and drafts., 39, speaks English, French, German, Spanish, would travel Europe for cycle and other machinery, tools, japans and sundries; 20 years in business, 10 in Europe. Box 17, American Machinist.

Foundry Foreman—A first-class man, with special exp. in one of best shops in this country, is ready for an engagement; understands brass as well as iron founding; selecting and mixing irons a specialty for any purpose. Ad. "Moulder," Am. Mach.

A die and toolmaker, well up in all modern improved dies for stamping, forming and cutting for all sheet metals, as brass, iron, steel, tin, etc.; can develop ideas; 15 years experience; best references; can accept at once. Die Maker, care Am. Mach.

Help Wanted.

Reliable mechanics to sell my calipers, etc.; good pay. Address E. G. Smith, Columbia, Pa.

Machinist wanted with $1,500 to join me with same amount in safe paying business. Address P. O. Box 36, Sparta, Wis.

Thoroughly good machinist, lathe or floor hand, to act as foreman at times in small shop; state terms. Box 30, American Machinist.

Wanted—First-class man for crank lathe, also planer; permanent and desirable places for really good men. Box 25, American Machinist.

Wanted—Foreman for foundry of New England concern manufacturing engines and machinery; young or middle-aged man, steady and reliable, experienced in modern practice; iron and brass; give age, experience, references and salary expected. Box 26, American Machinist.

Wanted—A man who can handle men and economically operate boilers, engines, refrigerating mach'y and elec apparatus, to act as chief eng'r for a packing house. Address in own handwriting, giving experience, age and salary expected, H. C. G., Room 46, 240 La Salle Street, Chicago.

Machinists wanted in manfg. line. Works in operation 17 years without a case of shut-down, reduction of wages, or laying off of help. Wages $2 per day to ordinary machinists or machine men: $2.25 per day for good men on floor work. Factory in a small country town, one hour's ride from New York City. Preference given to men of family who will remove here for permanent residence. None but competent men need apply. State age, experience and give references. Box 19, care American Machinist.

▲ ▲ ▲

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d h'd lathes & planers. S. M. York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

For sale cheap, 250-ton vertical hydraulic press C. C. Hill, Chicago.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Will sell at low figure patent No. 569717 Lubricator Pump. Fr. Kaufhold, Merseburg a/S. Germany.

Models, experimental and small special machy. built. Write to Crocker & Lawson, Binghamton, N. Y.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

Wanted—Every reader of this paper to send 35 cents for The Tool Catalogue. See Montgomery's advertisement on page 15 of this edition.

Wanted—Inventors before applying for a patent get "How to Apply for a Patent," $1. Sample pages free. Henry F. Noyes, 56 Liberty Street, N. Y.

Wanted—The address of every young man who wishes to study mechpnical engineering at a low cost. Mech. Dept., Agricultural College, P. O., Mich.

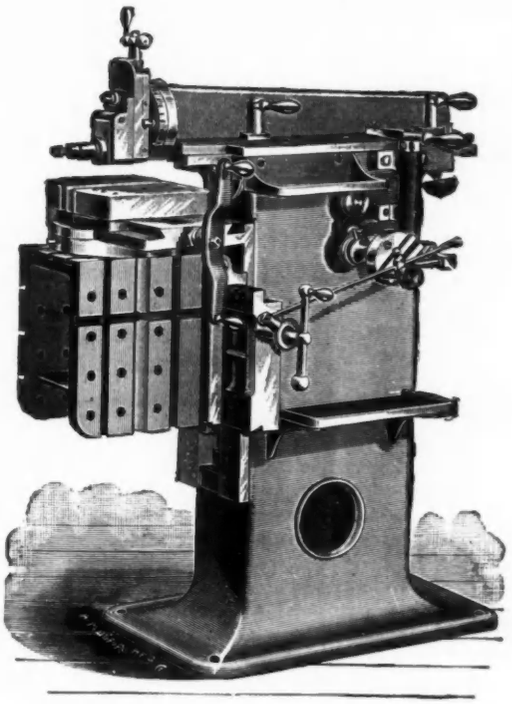
Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offered to inventors.

A machine shop, with modern equipment, heavy and light machinery, cranes of 20 tons capacity and 10,000 square feet of unoccupied floor space, would contract to manufacture any kind of machinery. Parties already having machinery built under contract might do well to write us for estimates. Box 62, American Machinist.

Columbia University
in the City of New York.

SCHOOL OF MINES,
SCHOOL OF CHEMISTRY,
SCHOOL OF ENGINEERING,
SCHOOL OF ARCHITECTURE,
SCHOOL OF PURE SCIENCE.

Four years' undergraduate courses and special facilities for graduate work in all departments. Circulars forwarded on application to the Secretary of the University.



..IMPROVED..

15-inch Hendey Shaper.

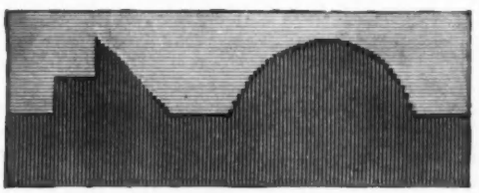
Latest Improvements.
Useful Attachments.
Strong and Powerful.

...FOR...

Die Work, Tool Room or General Shop Work.

▲ ▲ ▲ ▲

The stroke can be adjusted for curves with machine in motion. The stroke can be adjusted for angles with machine in motion. The stroke can be adjusted for irregular work with machine in motion. It has adjustable table for planing taper work; table can be removed for fastening work to apron. Has a strong graduated swivel vise. Quick work, rapid changes, modern ideas.



This cut shows how stroke can be adjusted with machine in motion by micrometer; adjustment fine and delicate. SEND FOR CIRCULAR.

▲ ▲ ▲ ▲

THE HENDEY MACHINE CO.

TORRINGTON, CONN.

Agents for the Pacific Coast—PACIFIC TOOL AND SUPPLY COMPANY, San Francisco, Cal.

European Agents, { CHAS. CHURCHILL & CO., London and Birmingham. SCHUCHARDT & SCHÜTTE, Berlin and Vienna. EUGEN SOLLER, Basel, Switzerland.

(Continued from page 34.)

should be at this season of the year. West Indian trade is relatively better than South American, because of the unfavorable exchange rates from the latter, particularly from Brazil.

EXPORT NOTE.

The United States Consul at San Juan del Norte has informed the State Department that after July, 1897, all invoices, bills of lading, etc., presented at the Custom House at Bluefields will be rejected if the weights and measures therein mentioned are not expressed in metric denominations.

Quotations.

NEW YORK, Saturday, May 29.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 00 @ $12 50
No. 2 foundry, Northern	11 00 @ 11 25
No. 2 plain, Northern	10 50 @ 11 00
Gray forge, Northern	9 75 @ 10 25
No. 1 foundry, Southern	10 25 @ 10 75
No. 2 foundry, Southern	9 75 @ 10 00
No. 3 foundry, Southern	9 50 @ 10 00
No. 1 soft, Southern	10 25 @ 10 50
No. 2 soft, Southern	9 75 @ 10 00
Foundry forge, or No. 4, Southern	9 25 @ 9 50

Bar Iron—Base- Mill price, in carloads, on dock: Common, 1.00 @ 1.05c.; refined, 1.10 @ 1.25c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.35 @ 1.45c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some brands perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.50c.

Cold Rolled Steel Shafting—Base size, 2.50c., in small lots, from store.

Copper—Carload lots, Lake Superior ingot, 11⅛ @ 11¼c.; electrolytic, 10⅝ @ 10⅞c.; casting copper, 10½ @ 10¾c.

Pig Lead—In carload lots, 3.25c., f. o. b., New York.

Pig Tin—For 5 and 10-ton lots 13.65 @ 13.70c., f. o. b.

Spelter—In carload lots, New York delivery, 4.20 @ 4.25c., f. o. b.

Antimony—6¾ @ 7¼c., according to brand.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 36 @ 38c.

▲ ▲ ▲

New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

We have received from Keuffel & Esser Company, New York, a catalog of drawing instruments, with prices included. The catalog contains about 420 pages, and is 5½ x 8¼ inches.

We have received from the Diamond Clamp & Flask Company, Richmond, Ind., a catalog of pattern shop supplies, such as core box pins, clamps, fillets, etc. The catalog is 2¾ x 5¼ inches.

R. K. Le Blond, Cincinnati, O., has sent us a catalog containing illustrations and descriptions of lathes, drills, tapping machines and other machine tools. The catalog is standard size, 6 x 9 inches.

We are in receipt from the D. E. Whiton Machine Company, New London, Conn., of an illustrated catalog and price list of lathe and drill chucks. The catalog is standard size, 6 x 9 inches.

Wiley & Russell Manufacturing Company Greenfield, Mass., send us a catalog of machinists' tools, including dies, mandrels, reamers, taps, etc. The catalog contains 204 pages, and is 3½ x 5½ inches.

The Wilbraham Baker Blower Company, of Philadelphia, Pa., has sent us a catalog containing descriptions and illustrations of the "Green" pressure blowers and gas exhausters. The catalog is standard size, 6 x 9 inches.

F. D. Winkley & Co., of Madison, Wis., have sent us a small catalog of oil-hole covers. These are made in various sizes, and several letters from those who use them are given. The catalog is standard size, 3½ x 6 inches.

Priestman & Co., of Philadelphia, Pa., send us a catalog of the Priestman safety oil engine. Half-tone engravings are given of this engine, and a number of testimonial letters are included. The catalog is 6 x 9½ inches.

The D. E. Whiton Machine Company, New London, Conn., sends us a catalog of automatic gear cutting machine; also one illustrating and describing lathe and drill chucks. Both catalogs are standard size, 6 x 9 inches.

Wais & Roos Punch & Shear Company, Cincinnati, O., have sent us a catalog of punching, shearing, crimping and bending machines. The catalog is standard size, 6 x 9 inches, and will be mailed to any interested upon application.

We have received from the Pennsylvania Bolt & Nut Company, Lebanon, Pa., a catalog containing 90 pages and bound in cloth. It contains illustrations of various kinds of rivets, forgings, spikes, nuts, washers, etc., and is standard size, 6 x 9 inches.

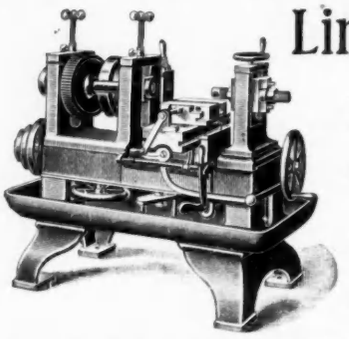
We are in receipt from the Gisholt Machine Company, Madison, Wis., of two catalogs, one devoted to the description of tool grinders, and the other to a general line of machine tools, including lathes, screw machines, etc. Both the catalogs are standard size, 6 x 9 inches.

We have received from the Murray Iron Works Company, Burlington, Ia., catalog No. 28, containing illustrations and descriptions of the Sioux Corliss engines. Very full particulars of the different parts of these engines are given, and the catalog is standard size, 6 x 9 inches.

We have received from Charles P. Willard & Co., Chicago, Ill., a catalog in which are described and illustrated various styles of marine engines and boilers especially suited to the propulsion of yachts, launches and other small craft. The catalog is standard size, 6 x 9 inches.

We are in receipt of a catalog and a supplement to that catalog from the Morse Machine Company, Rochester, N. Y., in which is illustrated and described all kinds of furniture peculiar to drafting rooms, including blue print frames, paper cabinets, drawing tables, easels, etc. The catalogs are 5 x 8½ inches.

The Toledo Machine & Tool Company, of Toledo, O., have just issued their 1897 catalog of dies, presses, shears, punches and other machines for working bar and sheet iron and steel. At the end of the catalog, which contains 127 pages, a telegraphic code is included for use when ordering or making inquiries. It is standard size, 6 x 9 inches.



Lincoln Milling Machine

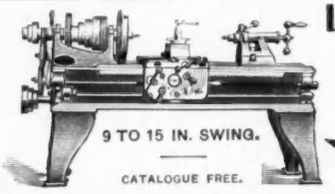
COLT'S MODEL, 1897.

With Foot Stock, Vise, Pan and Patent Adjustable Stop Mechanism that prevents breakage of mill teeth when the work is run up to the cutters.
Made in three sizes, with single and double spindles.
GRANT Single and Double Head Milling Machines, Vertical Spindle and Circular Milling Machines in variety, Milling Cutters, Milling Machine Vises and Centers.
Ask for the "Machinists'" Catalogue.

▲ ▲ ▲

THE PRATT & WHITNEY COMPANY,
HARTFORD, CONN., U. S. A.

NEW YORK: 123 Liberty St. BOSTON: 281 Franklin St. CHICAGO: 42 South Clinton St. LONDON, England: Buck & Hickman, 280 Whitechapel Road. PARIS, France: Fenwick Freres & Co., 21 Rue Martel.



Lathes! Planers!! Shapers, &c.!!!

Our tools are all of the latest and most approved designs, while the workmanship, material and finish are of the highest order. You will find it an advantage to have our catalogue and special prices before placing your order.

SEBASTIAN LATHE CO.,
117 and 119 CULVERT ST., CINCINNATI, OHIO.

Heating and Ventilating Buildings.

By R. C. CARPENTER.

8vo, Cloth, $3.00.

JOHN WILEY & SONS,
53 East 10th Street,
New York City.

Finest Machine Relieved Taps and Adjustable Tap Wrenches
IN CASES.
SCREW PLATES, DIES, &C.
SEND FOR CATALOGUE.
WILEY & RUSSELL MFG. CO.,
GREENFIELD, MASS., U. S. A.

MACHINIST'S SET—TAP WRENCH & TAPS
TAP WRENCH NO. 4 - 19 IN. LONG AND MACHINE RELIEVED
TAPER, PLUG & BOTTOMING TAPS ⅜ TO 1 IN. — 21 TAPS.
LIGHTNING

Agents in London, SELIG, SONNENTHAL & CO., 85 Queen Victoria Street.

DYER & DRISCOLL,
PATENT SOLICITORS, 36 WALL ST., N.Y.

Have done all my patent soliciting work, both for this and foreign countries, continuously for the past fourteen years.
Thomas A. Edison

STAR LATHES

★ ★ ★

Foot Power Screw Cutting, Automatic Cross Feed, 9 and 12" Swing.
Send for Catalog B.
Seneca Falls Mfg. Co.
697 Water St., Seneca Falls, N.Y.

'96 THE NEW '96 JENKINS '96

IS the Perfection of Joint Packing. Instantaneous, **Does Not Squeeze Out** and not necessary to follow up joint. We guarantee it to last for years on any and all pressures of steam or any kind of joint where packing is required. Does not rot, burn or blow out, therefore the best for all purposes. Call for and insist on having '96 JENKINS '96, stamped like cut. . . . . .

JENKINS BROS., New York, Boston, Phila., Chicago.

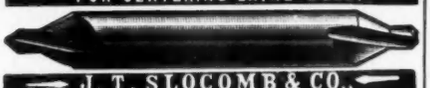
NORTON EMERY WHEEL CO.
SEND FOR CATALOGUE
WORCESTER MASS.

Die and Tool Steel.

NO BETTER MADE.

CRESCENT STEEL CO.
PITTSBURGH, PA.
CHICAGO, ILL.
NEW YORK, N. Y.
DENVER, COL.

COMBINED DRILL AND COUNTERSINK
FOR CENTERING LATHE WORK.

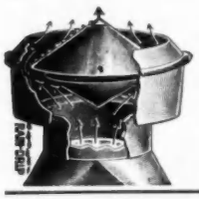


J. T. SLOCOMB & CO.,
PROVIDENCE, R.I. U.S.A.

STEEL FOR ALL PURPOSES.
Especially { BICYCLES. FIRE ARMS. MACHINE TOOLS.
Tell us what you want and you will get it.
PRATT & INMAN, Worcester, Mass.
Sixty-eight Years in the Steel Business.

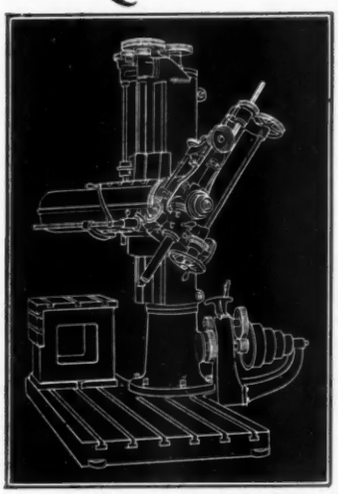
Illustrated Circular to Manufacturers.

A NEW PRODUCT | Finished Castings.
H. H. FRANKLIN MANUFACTURING CO.
Franklin Street, Syracuse, N. Y.



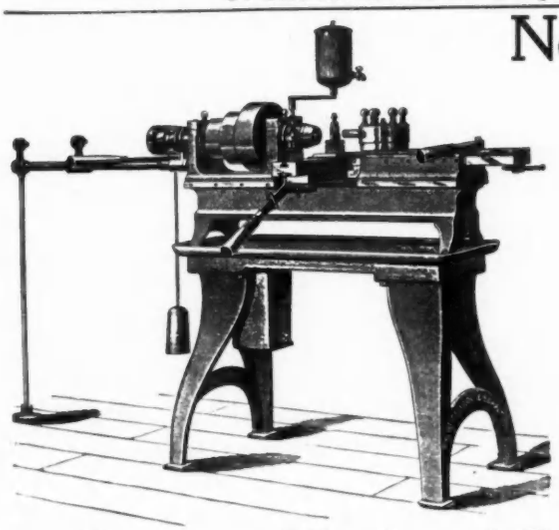
"THE WORLD'S BEST."
THE PANCOAST VENTILATOR.
HANDSOME, STRONG, DURABLE, EFFICIENT.
Leads them all in giving the best of Ventilation.
Houses, Mills, Factories, School-Houses, Churches, Refineries and *Founderies* use them with perfect results.
Architects in preparing plans for buildings should always specify the *Pancoast Ventilator.*
PANCOAST VENTILATOR CO., Inc., Manufacturers,
Offices, 316 Bourse Building, Philadelphia, Pa.
United States, Canadian and Foreign Patents.

PRENTICE BROS.,
WORCESTER, MASS. U.S.A.
Builders of
DRILLING MACHINERY AND ENGINE LATHES
FOR RAILROAD SHOPS, BRIDGE BUILDERS, BOILER MAKERS, SHIP YARDS
— AND —
GENERAL MACHINE WORKS.



CATALOGUE FREE.

No. 2 Prentiss Screw Machine.
Wire Feed.
Capacity, 1 in.



Machine Tools
Both New and Second-Hand.

Prentiss Tool and Supply Co.,
Chicago Store:
62 & 64 So. CANAL STREET.
115 LIBERTY STREET,
NEW YORK.

Manufactures.

At Pawtucket, R. I., F. C. Sayles intends to erect a new bleachery.

The plant of the Riverside Machine Works, at Kokomo, Ind., is to be enlarged.

At East Liverpool, O., the plant of Buford Bros. was recently destroyed by fire.

William H. Grundy & Co., of Bristol, Pa., are erecting an addition to their mill.

At Richwood, Ga., the mill owned by Mr. George Parrott has been destroyed by fire.

The Forge & Bolt Company, of Chicago, Ill., has begun work on an addition to its plant.

The Acton Iron Works, of Birmingham, Ala., have begun the enlargement of their capacity.

The Roberts Machine Company, at Collegeville, Pa., is erecting an addition to its plant.

The Bellaire Edge Tool & Steel Casting Company is making preparations to remove to Columbus, O.

James Hillis & Son, Halifax, N. S., have commenced the erection of a new foundry on Campbell street.

The Somerville (N. J.) Woolen Company are putting in a new fulling mill, and will add other machinery.

At Black Rock, Ark., the Cooperage Company intends to erect a new building and install more machinery.

The plant of the Miller Iron Company, Providence, R. I., has been damaged to a considerable extent by fire.

The pottery works of the Parmenter Manufacturing Company, at East Brookfield, Mass., have been destroyed by fire.

At Chicago, the Champion Refrigerator Company has been incorporated by Frank L. Williams and J. Henry Westover.

At Duluth, Minn., the National Iron Company has been incorporated by J. Evered, Walter Evered, H. R. Armstrong and C. F. Doherty.

At Colorado Springs, Col., a new plant will soon start up under the name of the Edgar Car Sealing Company. Mr. W. K. Edgar is interested.

The Shear, Roll & Punch Company, of Cambridge City, Ind., will erect new buildings and place machinery just as soon as a suitable location can be found.

Babcock & Wilcox (Ltd.) have opened a new office at 21 St. Vincent place, Glasgow, Scotland, but the principal office is at their works, Renfrew, near Glasgow.

At Youngstown, O., the Granite Wall Plaster Company has been incorporated. Messrs. V. Heasley, J. W. Dickey, F. S. Culver and M. C. McNab are the incorporators.

The Carolina Manufacturing Company, Newberry, S. C., contemplate the erection of a plant at an early date. Mr. J. J. Lane is secretary and John W. Taylor, treasurer.

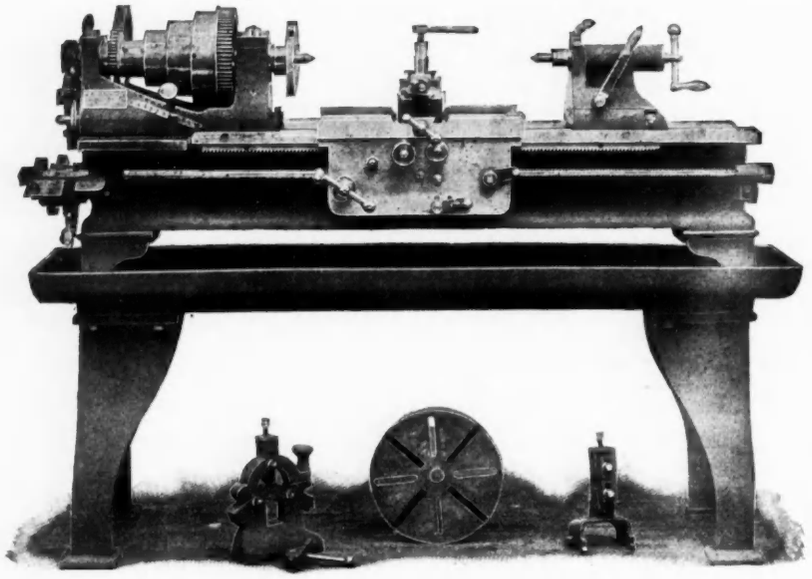
The Dorner & Dutton Company, of Cleveland, O., has been incorporated to engage in the manufacture of machinery. The incorporators are J. H. Van Dorn, E. J. Leighton, H. H. Hodell, W. A. Dutton and H. A. Dorner.

The West Leechburg Steel & Tin Plate Company, of West Leechburg, Pa., has been granted a charter. The directors comprise Messrs. D. M. Campbell, Leechburg; W. D. Patton, R. V. Reynolds and E. C. Ross, of Kitanning.

The Manufacturers' Steam Laundry Company, of Rosebank, Richmond County, N. Y., has been incorporated with a capital stock of $500,000. Leo Stern, Jacob M. Frank, of New York, and Edmund Posnansky, of Rosebank, are the directors.

We Desire to Sell All the 14-inch Lathes Wanted

▲ ▲ ▲



Have made prices so reasonable, and quality and capacity so good and great, that you cannot afford to overlook this Lathe, if you are in the market for a Lathe of this size.

We apply the planer principle on the Lathe, namely: VERY RAPID FEED FOR A FINISHING CUT.

It will do surfacing in ONE-EIGHTH THE TIME of the ordinary Lathe.

It will cut threads as coarse as TWO TO THE INCH as fine as 64 TO THE INCH; with all threads and fractions of threads that the combination of five times 11 gears will make.

THE GEARS ARE ALL MOUNTED AND NEVER NEED BE REMOVED.

It has independent friction and cross-feed, also friction length feed.

INDEX FOR SCREW-CUTTING IS EVEN MORE SIMPLE THAN ON THE OLD STYLE LATHE.

It has 1¼ inch hollow spindle.

It carries 2 inch belt.

It cuts threads as accurate as skill can produce.

It will earn more money than any Lathe offered.

It is simple; it is well made; it is accurate.

In short, it is indispensable.

In fact, you should write us about it

▲ ▲ ▲

The Lodge & Shipley Machine Tool Co.

CINCINNATI, OHIO, U. S. A.

Messrs. MARKT & CO., Ltd., Hamburg, Berlin and Paris, Agents for Continent of Europe.

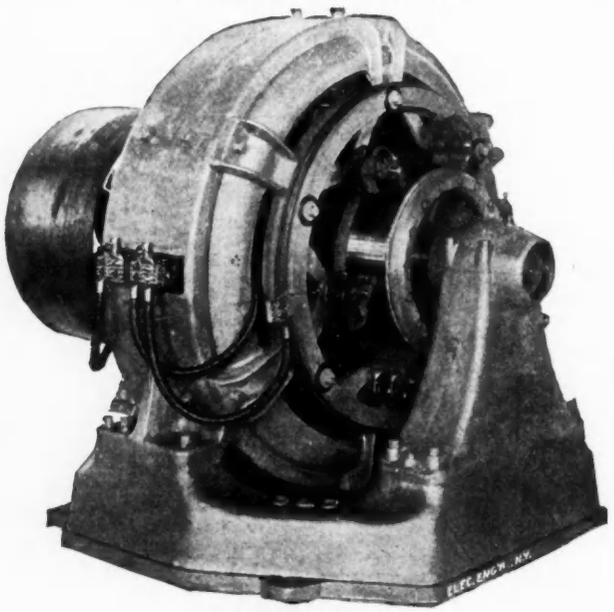
C & C Slow-Speed Generator,

(Direct Connected or Belted.)

Detachable and Interchangeable Field Coils.

Slotted Armatures.

Reaction Brush Holders.



SIX-POLE GENERATOR.

Low Temperature Increase.

High Efficiency.

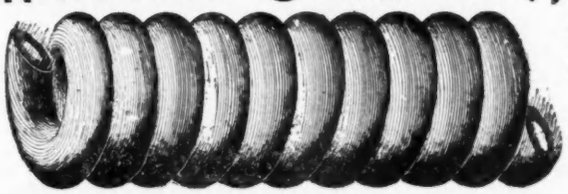
Large Self-Oiling and Self-Aligning Bearings.

Automatic Regulation at all Loads.

Branch Offices:
63 Oliver Street, BOSTON, MASS.
633 Arch Street, PHILADELPHIA, PA.
630 Equitable Building, ATLANTA, GA.

C & C ELECTRIC CO., 143 Liberty Street, New York.

HERCULES COMBINATION



METALLIC STOP VALVE PACKING

Leaves the stem clean

Write for Testimonials.

Patented and Manufactured Exclusively by

PEERLESS RUBBER MFG. CO.

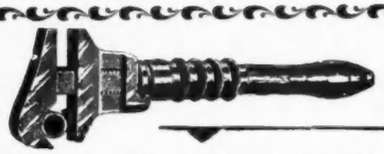
16 Warren St., NEW YORK.

16-24 Woodward Av., Detroit, Mich.
202-210 S. Water St., Chicago, Ill.

STANDARD TOOL CO.
MANUFACTURERS OF
MECHANICS FINE TOOLS
ATHOL, MASS. U.S.A.

BELLOWS' COMBINATION
TRY SQUARE, MITRE
CENTER SQUARE
PROTRACTOR & LEVEL

FREE CATALOGUE
40 PAGES
FINE TOOLS



Bemis & Call Hardware and Tool Co.

P. O. Box 2250 SPRINGFIELD, MASS.

Makers of Nut, Pipe, Combination and S. Wrenches, Calipers, Saw Sets, Punches, Etc.
Ask for book.

KEUFFEL & ESSER CO.

NEW YORK.

127 Fulton and 42 Ann Streets.

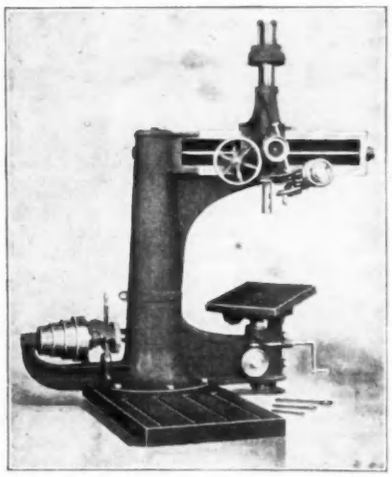
Branches:
111 Madison Street, CHICAGO.
708 Locust Street, ST. LOUIS.

Drawing Materials & Surveying Instruments.

Write for Keuffel & Esser Co.'s Catalogue of 1897. 28th Edition, 424 Pages, the most complete and reliable catalogue, representing the largest and most complete stock in this line.

Our goods are warranted to be in all cases exactly as described in our catalogue, and the selection there offered is made with intimate knowledge of the subject.

We make or control most of the goods we offer, which are different from, and superior to other goods, and the same makes and kinds are not obtainable otherwise than through us.



6-FOOT RADIAL DRILL.

THIS tool will drill a hole in the center of a 110-inch circle. If you are thinking of a Radial Drill you should investigate the many features of this machine.

We will send full description on request.

BEMENT, MILES & CO.

Philadelphia, Pa.

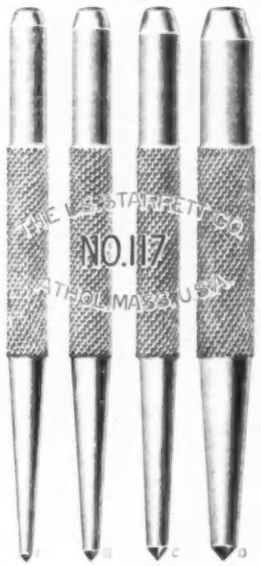
39 Cortlandt Street, NEW YORK. | 1534 Marquette Bldg., CHICAGO.

A complete line of machine tools.

MACHINISTS'

CENTRE PUNCHES

STARRETT QUALITY.



Of fine steel, both ends tempered, tops oval, points nicely ground. Length, each, 4 in. Diameter, A 5/64, B 6/64, C 7/64, D 8/32.

Price, each, .20; per doz., $2.00.

98 page Catalogue of Fine Tools and Cutters free. Ask for it.

THE L.S. STARRETT CO., BOX 59.
ATHOL, MASS., U.S.A.

De FRIES & CO.

IMPORTERS OF

AMERICAN MACHINES AND TOOLS,

BERLIN C. 49 Kaiser Wilhelmstrasse, GERMANY. DÜSSELDORF, Rhineland.

General Agents of the Davis & Egan Machine Tool Company. Cincinnati, Ohio.

WANT GENERAL AGENCIES FOR OTHER LINES OF MACHINES AND TOOLS FOR GERMANY, AUSTRIA, BELGIUM, HOLLAND, RUSSIA AND SCANDINAVIA.

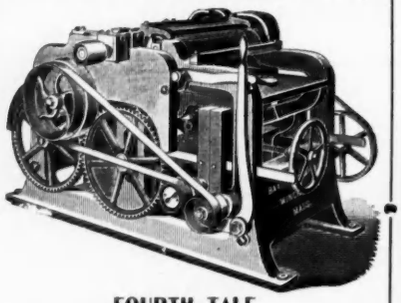
LARGE STORES IN BERLIN AND DÜSSELDORF provided with electric light, electric cranes, electric lift.

Machines seen in motion driven by a 20 H. P. electro-motor.

STUDY AT HOME Electricity, Mechanics, Steam Engineering.

By our Efficient Correspondence Method.
Our 72-Page Catalogue Explains. Sent Free.
Institute for Home Study of Engineering,
222 Seneca Street, CLEVELAND, O.

Plane Tales From Whitney

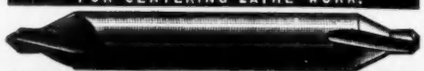


FOURTH TALE.

Cutter-head bearing of ample size, accurately fitted. Those on P-4 Planers are 10 inches long, 2 inches diameter. Genuine babbitt boxes, bored and hand-scraped.

Baxter D. Whitney,
WINCHENDON, MASS.

COMBINED DRILL AND COUNTERSINK
FOR CENTERING LATHE WORK.



J. T. SLOCOMB & CO.,
PROVIDENCE, R.I. U.S.A.

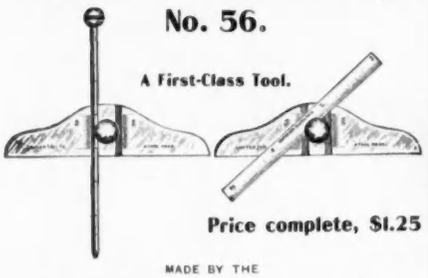
LEAD SCREW STEEL,
ROLLER STEEL,
MACHINERY STEEL.

PRATT & INMAN, Worcester, Mass.

Sixty-eight years in the Steel Business.

Depth and Bevel Gauge

No. 56.



A First-Class Tool.

Price complete, $1.25

MADE BY THE

SAWYER TOOL CO., Athol, Mass.

SEND FOR CATALOGU

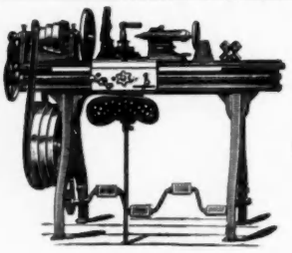
Manufacturers of Set, Cap & Machine Screws, Studs, etc.

Die and Tool Steel.

NO BETTER MADE.

CRESCENT STEEL CO.

PITTSBURGH, PA.
CHICAGO, ILL.
NEW YORK, N. Y.
DENVER, COL.



NO. 6 LATHE.
9" TO 13" SWING.

FOOT-POWER LATHES

FOR THE
ELECTRICIAN,
EXPERIMENTER,
BICYCLE REPAIRING,
GENERAL MACHINE SHOP WORK.

SEND FOR CATALOGUE.

W. F. & JNO. BARNES CO., 1995 Ruby St., ROCKFORD, ILL.

CHAS. CHURCHILL & CO., ENGLISH AGENTS, LONDON, E. C.

L. COES'

Genuine Improved
Knife Handle Patent

Screw Wrenches

Manufactured by

Coes Wrench Co., Worcester, Mass.

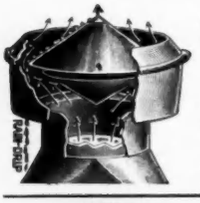
Established in 1839. Patented Dec. 15, 1891.
Registered April 9, 1895. Patented April 30, 1895.

Sectional View Illustrates our New Knife Handle, showing Manner of Construction.

STRAIGHT BAR, EXTRA LONG NUT FOR SCREW IN JAW.

The Best Made and Strongest Wrench in the Market.

J. C. MCCARTY & CO.
JOHN H. GRAHAM & CO. } NEW YORK AGENTS.



"THE WORLD'S BEST."

THE PANCOAST VENTILATOR.

HANDSOME, STRONG, DURABLE, EFFICIENT.

Leads them all in giving the best of Ventilation.

Houses, Mills, Factories, School-Houses, Churches, Refineries and *Founderies* use them with perfect results.

Architects in preparing plans for buildings should always specify the *Pancoast Ventilator.*

PANCOAST VENTILATOR CO., Inc., Manufacturers,
Offices, 316 Bourse Building, Philadelphia, Pa.

United States, Canadian and Foreign Patents.

SHAPERS

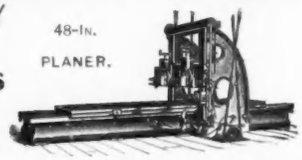
IMMEDIATE DELIVERY
ON 12-14 AND 18-IN. STROKE.

MANUFACTURERS OF OTHER FINE MACHINE TOOLS

FITCHBURG MACHINE WORKS
FITCHBURG, MASS., U. S. A.

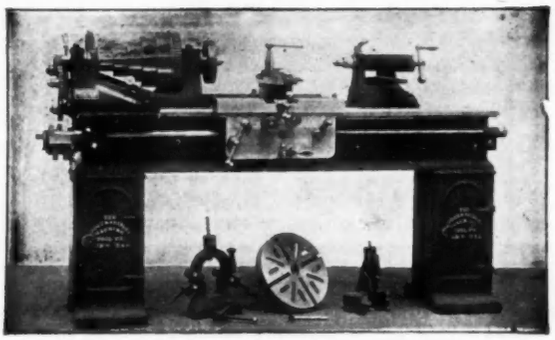
CATALOGUE E, SEND FOR IT.

48-IN. PLANER.



AUTOMATIC FRICTION CLUTCH CO.

CATALOG ON REQUEST.
821 STATE STREET,
ERIE, PA.



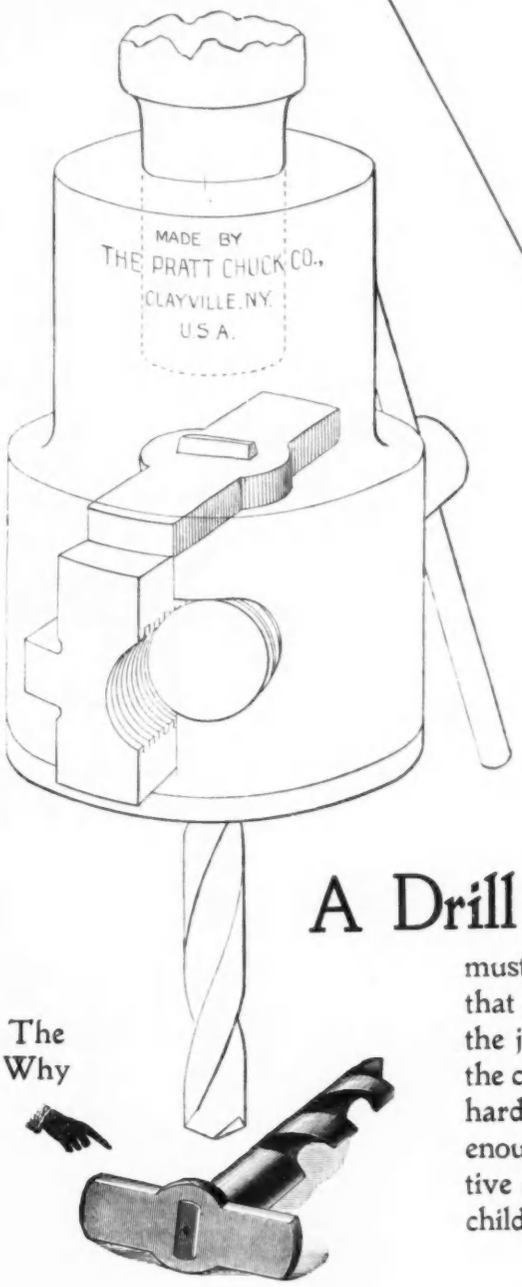
We Make the Bold Statement

That our 14 in. and 16 in. Lathes are UNEXCELLED. We erect FIFTY Lathes, including beds, at ONE TIME. We have fifty on the floor now finishing. We assert that they are capable of MORE WORK, have greater RANGE POWER and CAPACITY, for doing a varied character of work, within a given time, than ANY LATHE offered. We guarantee their TRUTH, ACCURACY and GOOD WORKMANSHIP. We can make INSTANT SHIPMENT of TWENTY-FIVE Lathes, if necessary.

THE LODGE & SHIPLEY MACHINE TOOL COMPANY,

CINCINNATI, OHIO, U. S. A.

SCHISCHKAR & CO., Birmingham, England, Agents for Great Britain. MARKT & CO., Ltd., Hamburg, Berlin and Paris, Agents for Europe.



Perhaps you think this is an eclipse — its real mission is to remind you that there is a Machine Tool Works making a specialty of reducing the cost and improving the product of any piece in metal, made in duplicate parts, that must be turned, faced, bored, or threaded. They make turret machines, boring mills and special lathes, study the needs of each case and furnish tools that save money, time and trouble. Ask for catalogue.

"The Bullard Machine Tool Co.
Bridgeport,
Conn.

A Drill Chuck

must hold drills true and prevent their slipping, if it don't do that it's a failure. Most drill chucks depend on the grip of the jaws,—if the drill slips the size number is wiped out and the chuck isn't helped any. Here is a chuck that bites just as hard as any of them, yet a drill can't slip if there is pressure enough on the jaws to keep it from falling out. The "positive driver" costs nothing extra—lasts, well let your grandchildren worry about that. Our Chuck Book free.

The Why

The Pratt Chuck Co., Clayville, N. Y.

TURRET
Boring and Turning Machine.

A Machine that no Shop can Afford
To be Without!

WRITE FOR FULL DESCRIPTION.

Beats the **Lathe** many times over for **Boring Small Work.**

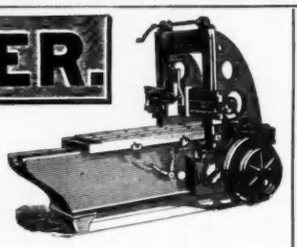
CORRESPONDENCE SOLICITED.

The Niles Tool Works Company,

Main Office and Works, HAMILTON, OHIO.

English Branch, 39 Victoria St., London, S.W. Branches: NEW YORK, CHICAGO, BOSTON, PHILADELPHIA, PITTSBURGH.

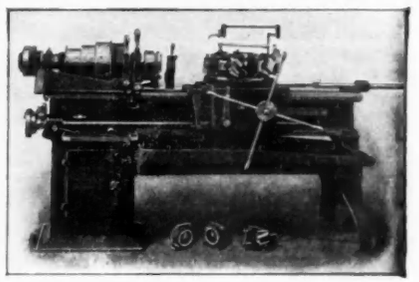
THE GRAY PLANER.



THE G. A. GRAY CO., CINCINNATI, O.

These Machines are sold by the following Agents:

HILL, CLARKE & CO., 14 South Canal St., Chicago, Ill.
STRONG, CARLISLE & TURNEY CO., 193 Bank St., Cleveland, O.
E. A. KINSEY & CO., 331 West Fourth St., Cincinnati, O.
THOS. K. CAREY & BROS. CO., 26 Light St., Baltimore, Md.
J. J. McCABE, 14 Dey St., New York City.
PACIFIC TOOL & SUPPLY CO., 102 First St., San Francisco, Cal.
SCHUCHARDT & SCHUTTE, Berlin, Vienna and Brussels.
CHAS. CHURCHILL & CO., Ltd., London and Birmingham, England.



The Flat Turret Lathe

Does Lathe work accurately up to 2 in. diameter by 24 in. long.

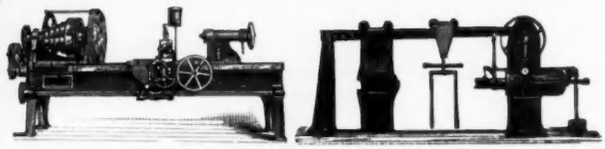
Jones & Lamson Machine Co.
Springfield, Vt., U. S. A.

Representative for Germany, Switzerland, Austria-Hungary, Russia, Holland and Belgium: M. KOYEMANN, Charlottenstrasse, 112, Dusseldorf, Germany.
England: HENRY KELLEY & CO., 26 Pall Mall, Manchester.

William Sellers & Co. Incorp. PHILADELPHIA.

HAVE YOU EXAMINED?

THE NEW TOOL GRINDER, No. 2?
THE CENTRIFUGAL SAND MIXER?
THE VICARS' MECHANICAL STOKER?



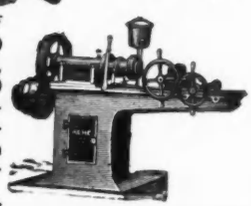
Something every manufacturer should know about. Circular describing Finished Castings on application.

A NEW PRODUCT = Finished Castings.

H. H. Franklin Mfg. Co., Franklin Street, Syracuse, N. Y.

THE ACME Machinery Co.
CLEVELAND, O.

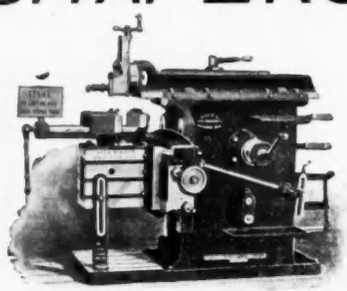
MANUFACTURERS OF ACME BOLT AND RIVET HEADERS, ACME SINGLE AND DOUBLE AUTOMATIC BOLT CUTTERS, cutting from 1-8 in. to 6 in. diam. ALSO SEPARATE HEADS AND DIES.



For Books on Electricity

Write to the
American Machinist Publishing Co., New York.

SHAPERS.



24 in. Extension Base Shaper.

"DOUBLE TRIPLE QUICK" STROKE. Gives 100 per cent. more strokes per minute than any other Shaper made.

Write for our '97 Shaper Catalog.

GOULD & EBERHARDT,
NEWARK, NEW JERSEY, U.S.A.

Foreign Agents: JOHN LANG & SONS, Johnstone, Scotland. SCHUCHARDT & SCHUTTE, Berlin, Vienna, Brussels. G. KORPPEN & Co., Moscow, Russia. Shaper Agents. WHITE, CHILD & BENEY, Vienna, Aus. Shaper Agents.

EXPORT TRADE A SPECIALTY. ST. LOUIS, MO.

SET AND CAP SCREWS
STUDS NUTS
CINCINNATI SCREW & TAP Co.
STANDARD AND SPECIALS.
CINCINNATI, O., U.S.A.
FOR ENGINES AND MACHINERY.

CLAYTON AIR COMPRESSOR WORKS
SEND FOR CATALOGUE. 26 Cortlandt St. NEW YORK.

CRANES

PAWLING & HARNISCHFEGER,
163 Clinton Street, MILWAUKEE, WIS.

GRANT GEARS

GEAR WHEELS CUTTING

Grant Gear Works,
125 South 11th Street, PHILADELPHIA.
6 Portland Street, BOSTON.
86 Seneca Street, CLEVELAND.
Send for Catalog.

MANUFACTURERS OF
Twist Drills, Reamers and Taps

THE STANDARD TOOL Co. CLEVELAND, OHIO.

CLEVELAND, OHIO.
Spring Cotters and Flat Spring Keys.